Vol. 14, No. 13
(Revised)
July 15, 1989

Energy Research Abstracts

Abstracts 26199-27791

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Vol. 14, No. 13
July 15, 1989
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

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ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

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Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

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Canada	Japan
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Italy	United Kingdom
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4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
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8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
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20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

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Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

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Corporate Author Index

The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the sample citation on the previous page would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 14:18255 (R;US)

Personal Author Index

Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 14:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)

Subject Index

This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
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Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 14:18686 (RA;SU;In Russian)

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DOE technical reports are listed by contract number. A typical entry is shown.

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FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
14:17641 DOE/ER/60664–1

Report Number Index

Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 14:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246/JAW MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 40 first-level and the 289 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

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Energy Research Abstracts

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0103 Preparation

26199 (DOE/PC/88878–T1) **Coal surface control for advanced fine coal flotation: Quarterly report No. 1, October 3, 1988–December 31, 1988.** California Univ., Berkeley, CA (USA); Praxis Engineers, Inc., Milpitas, CA (USA); Utah Univ., Salt Lake City, UT (USA); Columbia Univ., New York, NY (USA). 1988. 13p. DOE Contract AC22-88PC88878. Order Number DE89010647/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Preliminary work is reported. Topics include: coal procurement and weathering, sampling, sample preparation, site preparation, sample splitting, packing and identification. (CBS)

26200 (DOE/PC/88878–T2) **Coal surface control for advanced fine coal flotation: Quarterly report No. 1, October 3, 1988–December 31, 1988.** California Univ., Berkeley, CA (USA); Utah Univ., Salt Lake City, UT (USA); Columbia Univ., New York, NY (USA); Praxis Engineers, Inc., Milpitas, CA (USA). 1988. 13p. DOE Contract AC22-88PC88878. Order Number DE89010723/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The document is the first quarterly report prepared. This report will cover only the technical aspects of the work completed during the reporting period including: materials, procurement, sampling, grinding, and flotation tests.

26201 (DOE/PETC/TR–89/5) **Selective agglomeration: An interlaboratory test program.** Hucko, R.E.; Killmeyer, R.P.; Jacobsen, P.S. USDOE Pittsburgh Energy Technology Center, PA (USA). Mar 1989. 28p. (CONF-890238–3: Annual meeting and exhibit of the Society of Mining Engineers, Inc., Las Vegas, NV, US, February 27, 1989). Order Number DE89008898/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Among advanced coal preparation processes, various approaches to selective agglomeration have been recognized to have enormous potential in terms of producing a superclean fuel from coal. In order to compare and contrast the performance of different processes that have been developed within the generic area of selective agglomeration, the Department of Energy's Pittsburgh Energy Technology Center (PETC) conducted an interlaboratory test program in 1988. Organizations that agreed to participate received carefully split samples of three bituminous coals with the goal of obtaining the maximum Btu recovery at a clean coal ash content of roughly 2%. The process developers ground and beneficiated the coal, and returned the products to PETC for analysis. This paper describes the various process schemes that were evaluated and presents an overview of the major findings. 5 refs., 9 figs., 7 tabs.

0104 Processing

Refer also to citation(s) 26227, 26263, 26507

26202 (AE/SESR–1988) **Co-processing studies of Alberta subbituminous coals.** Alberta Energy, Edmonton (Canada). Scientific and Engineering Services and Research Div. 1988. 15p. (MICROLOG–89-01060). Available from Alberta. Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Conventional crude oil production from established Canadian oil fields is expected to decline sharply after 1990. While production of synthetic crude oils form coal or bitumen can be entirely separated, research work indicates that a more promising alternative is to produce liquid fuels from mixtures of coal and bitumen. This is called co-processing, and it has been the subject of several research investigations in Alberta since 1979. Laboratory and bench-scale experiments are briefly discussed. The pyrosol and CCLC processes are compared. Those elements of any coal liquefaction process, including co-processing, that have the greatest effect on process economics are temperature, pressure and reactor residence time. A review was made at the Alberta Research Council of 13 processes that represent recent advances in hydrogen addition under conditions that are less severe than those commonly used to liquefy coal. The characterisation of coal liquids are presented. The isotopic ratio ^{13}C sup 12/C allows one to determine the proportion of the carbon in the synthetic crude oil that was derived from coal. 38 refs., 5 figs. 2 tabs.

26203 (CONF-8707212–) **Biological treatment of coals workshop: Proceedings.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA); USDOE Idaho Operations Office, Idaho Falls, ID (USA). 1987. 458p. From Biological treatment of coals workshop; Vienna, VA, US; July 8, 1987. Order Number DE89010545/JAW. Available from NTIS, PC A20/MF A01 - OSTI; GPO Dep.

Research programs on bioconversion of coal are presented. Research areas include: Microbial solubilization and desulfurization, recent progress in coal bioprocessing in the USA, recent progress in Europe, a research plan for biogasification, and biological conversion of synthesis gas into liquid fuels. Fourteen research programs under solubilization and desulfurization are also presented. Individual projects are processed separately for the data bases. (CBS)

26204 (DOE/MC/24116–T1) **Development of an advanced, continuous mild gasification process for the production of co-products: Quarterly report, July 16–October 15, 1988.** Chu, C.I.C.; Gillespie, B.L. UCC Research Corp., Bristol, VA (USA). Nov 1988. 10p. DOE Contract AC21-87MC24116. Order Number DE89003866/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of this project is to develop a continuous mild gasification process which will meet the needs stated above. The program consists of four tasks. Task 1 was a literature survey of mild gasification processes and product upgrading methods as well as a market assessment of mild gasification products. Based on the results of the literature survey, a mild gasification process and a char upgrading method were selected. Task 2 consists of bench-scale studies with the selected mild gasification reactor to generate the design data for the larger scale reactor. Task 3 consists of bench-scale char upgrading studies. Upon successful completion of Tasks 2 and 3, optional Task 4 will be construction and operation of an integrated process development unit. A technical and economic evaluation of a continuous mild gasification demonstration plant will also be conducted. 3 refs.

26205 (DOE/PC/79928–T6) **Solid superacids as coal liquefaction catalysts: Quarterly report, October–December 1988.** Tierney, J.W.; Wender, I. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. 1988. 9p. DOE Contract FG22-87PC79928. Order Number DE89010818/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Direct coal liquefaction under mild conditions can be achieved by the use of strong acid catalysts including gaseous and liquid superacids. This research aims at exploring the possibility of mild coal liquefaction in the presence of solid superacids, especially SO_4^{2-} modified oxides of iron, zirconium, titanium, and hafnium. Fe_2O_3/SO_4^{2-} has been shown to be an impressively active catalyst in coal conversion at 400°C[4]. Our objective is to find conditions under which Fe_2O_3/SO_4^{2-} and similar systems catalyze the conversion of coal at lower temperatures. So far, Fe_2O_3/SO_4^{2-}, ZrO_2/SO_4^{2-} and TiO_2/SO_4^{2-} catalysts have been synthesized and characterized by XRD, BET, IR, acidity measurement, and sulfur analysis. We continued to refine the preparation techniques for these solid superacid catalysts as well as their use in testing reactions, namely conversion of n-pentane and dehydration of isopropyl alcohol. 4 refs., 2 tabs.

26206 (DOE/PC/80908–11) **Low severity coal conversion by ionic hydrogenation: Report for the period of January–April 1989.** Maiorielio, J.; Larsen, J.W. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. 19 Apr 1989. 8p. DOE Contract FG22-85PC80908. Order Number DE89010481/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ionic hydrogenation of coal is being studied. A variety of ionic hydrogenation systems were screened using two test compounds in the search for effective acid/H_2/catalyst combinations. A new ionic hydrogenation system using H_2O:BF_3/H_2/$(CH_3CN)_2PtCl_2$ was found to hydrogenate aromatics/polynuclear aromatics (PNAs) and to cleave C–O bonds. The H_2O:BF_3/H_2/$(MeCN)_2PrCl_2$system was applied to Wyodak coal in an attempt to develop efficient, near-room-temperature coal conversion chemistry. An ionic hydrogenation system consisting of H_2O:BF_3/H_2/MoS_2 was applied to Beulah Zap lignite in order to determine the effectiveness of the ionic hydrogenation reaction while employing heterogeneous transition metal sulfides as catalysts. Two ionic hydrogenation systems, BF_3:H_2O\$Et_3SiH$ and BF_3:H_2O\$PtCl_2(CH_3CN)_2$\$H_2$ were applied to the pyridine soluble portion of an ion-exchanged Wyodak subbituminous coal. A series of THF soluble organic acids along with Et_3SiH were used to hydrogenate the THF soluble portion of a Pitt. No. 8 bituminous coal. 4 refs., 1 fig., 1 tab.

26207 (DOE/PC/88814–T1) **Fundamental studies of retrograde reactions in direct liquefaction: First quarterly report, October 1, 1988–December 31, 1988.** Serio, M.A.; Solomon, P.R. Advanced Fuel Research, Inc., East Hartford, CT (USA). 1988. 17p. DOE Contract AC22-88PC88814. Order Number DE89010822/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The results of the experiments in the proposed program will lead to an improved mechanistic understanding of retrograde reaction mechanisms in liquefaction, that can be used to explore improved process concepts designed to minimize retrograde reactions and, thus, to improve liquefaction yields. SRI has attempted direct polymerization of eugenol, a readily available starting material to produce a C-C-O polymer. However, the yields were too low, probably because the Hg $(NO_3)_2$ catalyst was too moist. However, polymerization with $Hg(CF_3CO_2)_2$ in nitromethane proceeded smoothly. Product characterization using NMR and GPC is currently underway. Twenty-four samples of each of the three Argonne coals which will be used in this study were ordered. Characterization of these samples using TG-FTIR and SEM/X-ray has begun at AFR. 5 refs., 3 figs., 1 tab.

26208 (DOE/PC/88855–T1) **Enzymatic desulfurization of coal: Third quarterly report.** Marquis, J.K.; Kitchell, J.P. Holometrix, Inc., Cambridge, MA (USA). 14 Mar 1989. 45p. DOE Contract AC22-88PC88855. Order Number DE89010913/JAW. Available from NTIS, PC A03 - OSTI.

Our current efforts to develop clean coal technology emphasize the advantages of enzymatic desulfurization techniques and have specifically addressed the potential of using partially-purified extracellular microbial enzymes or commercially available enzymes. Our work is focused on the treatment of "model" organic sulfur compounds such as dibenzothiophene (DBT) and ethylphenylsulfide (EPS). Furthermore, we are designing experiments to facilitate the enzymatic process by means of a hydrated organic solvent matrix. In this quarter we obtained important results both with the development of our understanding of the enzyme reaction systems and also with the microbial work at Woods Hole. 12 figs., 11 tabs.

26209 (DOE/PC/88915–T2) **Steam gasification of carbon: Catalyst properties: Quarterly report, December 15, 1988–March 14, 1989.** Falconer, J.L.; Lauderback, L.L. Colorado Univ., Boulder, CO (USA). 31 Mar 1989. 6p. DOE Contract FG22-88PC88915. Order Number DE89010821/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This research uses three techniques to study catalyzed gasification of carbon in an effort to determine the concentration of catalyst sites on a carbon surface and thus determine how effectively a catalyst is utilized for steam gasification. Both alkali and alkaline earth oxides are effective catalysts for accelerating the gasification rate of coal chars, but in many cases only a fraction of the catalyst is in a form that is effective for gasification. We will study the steam gasification of carbon in order to determine the concentration of active catalyst sites, the composition of the catalyst, and the location of the catalyst on the surface. Transient isotope tracing (switching reactant feed gases between $H_2{}^{16}O$ and $H_2{}^{18}O$) will be used to measure the concentration of sites at steady-state reaction conditions. A steady flow of $H_2{}^{16}O$ in He will be replaced by $H_2{}^{18}O$ in He, while maintaining the same reaction rate, and the change in product signals will be detected with a computer-controlled mass spectrometer. Secondary ion mass spectrometry (SIMS) will be used for both high surface area samples of carbon/carbonate mixtures that are heated in steam to various temperatures and for model surfaces with deposited ions. Scanning tunneling microscopy (STM) will be used to determine catalyst dispersion and the location of catalyst on the surface.

26210 (DOE/PC/88917–T1) **A new approach in ultrapurification of coal by selective flocculation: Quarterly report.** Moudgil, B.M. Florida Univ., Gainesville, FL (USA). Dept. of Materials Science and Engineering. Mar 1989. 32p. DOE Contract FG22-88PC88917. Order Number DE89010820/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Preparation of coal, coal refuse, quartz and clay samples along with proximate and ultimate analyses of coal and coal refuse were completed. The coal pyrite sample is expected to be received soon. Several polymers of different nature, ionic character and molecular weight were examined for their potential as selective flocculants for only coal or coal refuse. Based on single component flocculation tests, Superfloc 362 (polyacrylamide), (highly cationic), exhibited selectivity towards flocculating quartz/coal refuse. Superfloc 206 (acrylate/acrylamide copolymer), highly anionic, on the other hand, seems to flocculate coal and clays. Flocculation tests of the coal-quartz system with Superfloc 362 indicated the possibility of separating coal from the mixture. Mathematical simulation of selective flocculation of coal/clay and coal/quartz with respect to the effect of the active sites ratio at two levels of impurity content has been completed. It is indicated that selectivity in these systems is possible even when the active sites ratio is low. In other words, it is not necessary to completely eliminate the active sites (for polymer adsorption) on the inert component to achieve the desired separation. 17 refs., 11 figs., 3 tabs.

26211 (DOE/PC/90909–T9) **Low severity coal liquefaction using homogeneous basic nitrogen catalysts: Technical progress report, August 1988–October 1988.** Miller, R.L.; Baldwin, R.M. Colorado School of Mines, Golden, CO (USA). Dept. of Chemical Engineering and Petroleum Refining. 1988. 31p. DOE Contract FG22-86PC90909. Order Number DE89010942/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work continued to evaluate potential methods for reducing nitrogen adduction and thermal degradation during low severity coal liquefaction. By employing two fractional factorial experimental designs, the statistical effects of reaction severity, coal rank, solvent type (petroleum- or coal-derived), nitrogen compound promotor (1,2,3,4-tetrahydroquinoline (THQ) or dipropylamine), heterogeneous catalyst addition, and H_2S addition on single-stage process performance were determined. In addition to the extent of nitrogen adduction, THF soluble coal conversion, C_4-454°C distillation yield, 454°C+ THF soluble residuum yield, hydrogen consumption, and model nitrogen compound recovery were used as measures of process performance. Hydrogen consumption and model nitrogen compound recovery results are discussed in this report. 8 refs., 10 tabs.

26212 (EPRI-GS–6318) **Evaluation of a Dow-based gasification-combined-cycle plant using low-rank coals: Final report.** Jarzabek, R.L.; Matchak, T.A. Electric Power Research Inst., Palo Alto, CA (USA); Fluor Daniel, Inc., Irvine, CA (USA). Apr 1989. 190p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Electric Power Research Institute (EPRI) has sponsored a series of engineering and economic evaluations for a number of gasification processes, with an emphasis on second-generation technologies. This report presents the results of a detailed evaluation of the Dow Gasification Process applied to an integrated combined-cycle power plant. Dow's process was evaluated because it offers very attractive performance on low rank coals while retaining the simplicity of a slurry-fed entrained gasifier. Plant designs

and cost estimates were prepared for two complete cases: for a plant firing South Hallsville (Texas) lignite, a coal readily available to the Gulf Coast utilities; and for a plant firing Rochelle (Wyoming) subbituminous coal, the same coal currently being used in Dow's commercial scale demonstration unit. The plant configuration and bases for the two cases are similar. Rough performance estimates for alternate lignite and subbituminous coals were also made, for comparison purposes. A financial analysis, investigating the effects of coal price, capacity factor and real escalation rate was performed for both the lignite and subbituminous plants. The results of this study show that the lignite plant has a total capital investment of $1203/kW at a heat rate of 9628 Btu/kWh (HHV). The subbituminous plant has a total capital investment of $1113/kW at a heat rate of 8672 Btu/kWh (HHV). However, at a real escalation rate of 0% for both coals, the cost of electricity is comparable for the two plants at expected plant availability. At higher escalation rates for the subbituminous coal, the lignite has a lower cost of electricity at all plant capacity factors. 16 figs., 31 tabs.

26213 (FRNC-TH-2331) **Correlation between the microtexture of coals and mixtures and the coking parameters (study of the molecular orientations by transmission electron microscopy).** Bensaid, F. Orleans Univ., 45 (France). 1983. 201p. (In French). Order Number DE89760550/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

Previous studies on coals are first recalled: composition, optical studies, TEM studies, mechanical properties, classification, pyrolysis, industrial coking. Then stucture and microtexture are investigated, using transmission electron microscopy, for quantitative characterization of a cokefied coal. Samples examined include 16 coal of increasing rank and 22 mixtures-additives (coal-coal, coal-coal tar pitch, coal-petroleum pitch and coal-malthene).

26214 (FRT-82-D-0430) **Rapid hydropyrolysis and hydrogasification of coal in a molten metal bath.** Carson, D.; Cwiklinski, C. Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), 75 - Paris. 1984. 31p. Order Number DE89760552/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Thermal conversion of coal into fluid products is studied in the laboratory by hydrogenation and pyrolysis in a metal bath at atmospheric pressure. Pulverized coal and hydrogen are injected at high temperature in a metal bath fluid products (liquid and gas) and a solid residue are produced. Influence of the metal of the bath (lead, tin, iron) and of temperature range (700^0 - 1300^0) are examined.

26215 (NP-9764597) **Development of new types of seals for coke oven doors and cleaning systems for coke oven doors and frames.** Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.). Apr 1985. 143p. (In German). Order Number DE89764597/JAW. Available from NTIS (US Sales Only), PC A07/MF A01;1V 07/MF A01.

Emissions of coke ovens occur nearly throughout the whole carbonisation time, especially as a result of leakage from the vertical coke oven doors which may be up to 6 m high. The leakages are caused by deformations of the metal/metal seals. Present cleaning systems, too, cause damage in the sealing elements. Bergbau-Forschung GmbH therefore cooperated with Ruhrkohle AG to develop new types of coke oven doors and a cleaning system at Zollverein coking plant. The following sub-projects were worked on: status report, analysis of the causes of emissions, testing of novel door seals and door constructions, development of an efficient and non-damaging door cleaning system. The findings are described and discussed. (MOS).

26216 Surface acoustic wave dust deposition monitor. Fasching, G.E.; Smith, N.S. Jr. To Dept. of Energy. USA Patent Application 7-155,452. 12 Feb 1988. 24p. Order Number DE89010808/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A system is disclosed for using the attenuation of surface acoustic waves to monitor real time dust deposition rates on surfaces. The system includes a signal generator, a tone-burst generator/amplifier connected to a transmitting transducer for converting electrical signals into acoustic waves. These waves are transmitted through a path defining means adjacent to a layer of dust and then, in turn, transmitted to a receiving transducer for changing the attenuated acoustic wave to electrical signals. The signals representing the attenuated acoustic waves may be amplified and used in a means for analyzing the output signals to produce an output indicative of the dust deposition rates and/or values of dust in the layer. 8 figs.

26217 (PB-89-161442/XAB) **Advanced coal-gasification technical analyses. Final report, April 1985-December 1988.** Smelser, S.C.; Earley, P.I. Fluor Technology, Inc., Irvine, CA (USA). Jan 1989. 145p. Available from NTIS, PC A07/MF A01.

See also PB-86-203130.

Twelve techno-economic studies of coal-to-pipeline gas facilities were performed to identify the advantages and disadvantages of various processes. Realistic combinations of processes were investigated to quantify the overall efficiencies and economics. These studies address a variety of coal gasifiers as well as downstream processing concepts, including catalytic conversions and acid-gas removal. The report contains a summary of the results of each study, a comparison of the 1983 and 1986 FRI Guidelines, and a procedure for converting the levelized constant-dollar costs-of-gas based on one set of Guidelines to costs based on the other set of Guidelines.

26218 (PIRSEM-2055) **Application of pneumatic transport multitubular reactor to coke and coal gasification.** Gau, G. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PRISEM). 1986. 70p. (In French). Order Number DE89760555/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The aim of this work is the modelization of circulating bed reactors and the study of their application to coal gasification or combustion. This type of reactor is more easy to simulate than a fluidized bed reactor because the only transfer phenomena concern the particle itself using kinetics formulas. The global behavior of a particle is described by a semi-empirical method and a direct simulation is developed with a small reactor.

26219 (UA-9010789) **Catalytic hydrogenation of bituminous coal and various coal extracts: Final report for the 1987-1988 SOMED project year.** Kispert, L.D. Alabama Univ., University, AL (USA). School of Mines and Energy Development. 1988. 19p. Available from OSTI - School of Mines and Energy Development, Box 6282, The University of Alabama, Tuscaloosa, AL 35487.

Naphthalene (II), quinoline (III), isoquinoline (IV), 6-methylquinoline (V) and 2-methylquinoline (VI) can be hydrogenated selectively to form 1,2,3,4-tetrahydronaphthalene (VII) (100% yield at 22°C), 1,2,3,4-tetrahydroquinoline (VIII) (73% yield at 22°C), 1,2,3,4-tetrahydroisoquinoline (IX) (70% yield at 90°C), 6-methyl-1,2,3,4-tetrahydroquinoline (X) (100% at 90°C), and 2-methyl-1,2,3,4-tetrahydroquinoline (XI) (76% at 90°C) by use of the Ziegler-type catalyst $Co(stearate)_2$-$AlEt_3$ (I) in a hexane solvent at a hydrogen pressure of 700 psi. Catalyst (I) does not hydrogenate dibenzothiophene, nitroquinolines or 4-chloro-2-methylquinoline. By extrapolating these results, a maximum yield of hydrogenation product from low sulfur coal using catalyst (I) was achieved by either maintaining the temperatures as low as 100°C for a long period of time or by conducting the process at high temperature (~150°C) for a short period of time. Hydrogenation of low sulfur coal resulted in a hydrogenated liquid product equal to 20% of the initial coal weight at 100°C and 800 psi hydrogen pressure. Microanalysis of the product showed the hydrogen content had doubled. On the other hand, attempts to hydrogenate high sulfur content coal (Illinois No. 6), gave unsatisfactory results. 27 refs., 3 tabs.

26220 (VTT-TUTK-531) **Tarry impurities developed in the gasification of indigenous fuels.** Simell, P. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1988. 79p. (In Finnish). Order Number DE88757335/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

In a gasification research into indigenous fuels (peat and wood) a method suitable for sampling tar and solids from the product gas was developed, its principle being that the gas sample is sucked through a heated probe, a solid matter filter and cooled solvent-filled gas scrubbing bottles. Simple gravimetric methods were

developed for analyzing the practically uncracked tar obtained from an updraft gasifier. A mixture of tar and solvent was obtained from sampling equipment. The solvent was evaporated either in evaporation dishes at room temperature, by distillation or on a thermobalance and the evaporation residue was weighed. The methods were tested by analyzing a solvent made from reference substances. The boiling point distributions and yields of compounds remained in the evaporation residues were determined. Different analyzing methods were also compared using results obtained for real tar samples. A gas chromatographic method was also developed for tar analysis. This method was used especially for analyzing the thermally cracked tar obtained, for example from a downdraft or fludized-bed gasifier. The GC-MS method was used for identifying tar compounds. Tar and solid contents and tar compositions obtained for the studied gasification methods were compared with each other. The studied processes were updraft, downdraft and fluidized-bed gasifiers and an updraft gasifier equipped with a separate cracking unit. The composition of the cracked tar was not affected by the fuel or by the process, in which the tar was carried into the hot zone and cracked, but the composition and content of the tar were changed most by the cracking temperature. On the other hand, the composition and content of the tar obtained from the updraft gasifier, developed mainly in the primary pyrolysis of the fuel, varied clearly depending on the fuel used.

0105 By-products

Refer also to citation(s) 26255, 26292

0106 Properties

Refer also to citation(s) 26201, 26203, 26213, 26811

26221 (DOE/PC/79907–T4) **Spectroscopic study of coal structure and reactivity: Quarterly report.** Griffiths, P.R. California Univ., Riverside, CA (USA). Dept. of Chemistry. 14 Feb 1989. 23p. DOE Contract FG22-87PC79907. Order Number DE89010646/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the first quarter of the second year of this project, two projects were investigated, namely the use of diffuse reflectance infrared Fourier transform (DRIFT) spectrometry to characterize fractions of coal extracts separated by thin layer chromatography (TLC), and continued studies of the application of resolution enhancement techniques for increasing the information content of coal spectra. Results from each of these projects are described below. 5 refs., 12 figs.

26222 (DOE/PC/88861–T15) **Reactivity of whole coals, selected pure maceral fractions, and cleaned coal products: Final report, January 1–December 31, 1988.** Crelling, J.C.; Hippo, E.J. Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center. Mar 1989. 127p. DOE Contract FC22-88PC88861. Order Number DE89010730/JAW. Available from NTIS, PC A07 - OSTI.

A long-term program is currently underway to determine the process response properties of pure single coal maceral fractions in order to predict the behavior of various whole coals of different maceral compositions and rank. The primary objectives of the study are to: (1) evaluate the reactivity of whole coals and macerals from other seams, covering the same broad rank range studied in the first phase of the program; (2) assess the degree of applicability of predictive equations for coals in general; and (3) evaluate the combustion characteristics of clean coals. This year, Argonne Premium samples were examined, as well as a number of coals obtained from various points throughout the US and the world (SIU coals). The coals were examined to determine if the relationships developed last year could be extrapolated to a wider rank range and maceral composition than the Hartshorne coals used in the last year's study. Efforts continued on modeling of the data obtained last year. Three cleaned and feed samples were obtained from OTISCA, Inc. Also, three feed and cleaned coals were obtained from the Pittsburgh Energy Technology Center and prepared. These coals will also be tested in the coming year's test matrix. A series of supercritical extraction (SCE) products, as well as the feeds, have also been tested. These samples were used to examine the effect of thermal desulfurization processing on combustion properties. A set of 50 samples has been obtained from the Pennsylvania State University. Twenty-five of these samples are of a rank series from the Lower Kittaning seam and will be used to further test and develop previously defined relationships. A second series is a set of high-sulfur coals. 20 refs., 2 figs., 3 tabs.

26223 (FRNC-TH–2425) **Relationship between the microtexture and the properties of carbon materials. Application to the characterization of coals.** Rouzaud, J.N. Orleans Univ., 45 (France). 1984. 215p. (In French). Order Number DE89760551/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

Cokes, semicokes and graphites produced by thermal treatment under inert atmosphere of coals with different coalification degrees are studied by transmission electron microscopy (microtexture) Raman spectrometry (defects) and optical microscopy (reflecting power). A unic model is elaborated for both carbonization and graphitization processes.

26224 (FRNC-TH–3006) **Contribution to the study of the low-temperature pyrolysis of coals.** Siga, A. Poitiers Univ., 86 (France). 1984. 90p. (In French). Order Number DE89760556/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Thermal degradation of three different coal is studied at temperature lower than 1000^0c in inert atmosphere and various atmosphere more or less oxidizing. Experiments are realized by thermal gravimetry and in reactor with different type of beds. Kinetic parameters are determined and results interpreted.

26225 (FRT–81-D-1090) **Petrography of the optical texture of cokes: methodology and applications.** Alpern, B. Orleans Univ., 45 (France). 1984. 193p. (In French). Order Number DE89760553/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

The quantitative petrographic method for the determination of coke texture by polarised light microscopy is described. Factors influencing texture are studied on coal mixtures and coal-additive mixtures. Applications to gasification in blast furnaces and underground coal gasification are examined. Influence of sodium and potassium compounds on coke gasification is investigated: reaction kinetics between coke and carbon dioxide is increased.

26226 (NEI-FI–72) **Peat classification and standards.** Impola, R.; Kallio, M.; Pirkkonen, P. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab. Apr 1986. 145p. Order Number DE88757336/JAW. Available from NTIS (US Sales Only), PC A07.

International Energy Agency: Programme on Research, Development and Demonstration on Peat Production and Utilization.

This subtask consists of gathering existing information on properties of peatland and peat and their correlations, and on methods of sampling and sample preparation, and on analysis methods of different properties of fuel peat products, as well as on fuel peat quality classification. Material for the report has been gathered from the literature and the different standards, as well as direct from the participating countries of this IEA project. Present condition of peat classification and standardization in all participating countries (Canada, Finland, Ireland, Sweden) and in the U.S.S.R. has been examined in this report. The most important standards (ISO, DIN, ASTM, GOST, SS, BS, Finnish fuel peat standard) applied to fuel peat have been collected.

26227 (VTT/KPA-COAL–3) **Effects of coal quality on utilization and maintenance costs of power plants. IEA Coal Research-Data transmission and distribution project.** Impola, R. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab. Jan 1989. 15p. (In Finnish). Order Number DE88757333/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

This literature review deals with the problem how changes in the most important properties of coal effect on utilization and maintenance costs of a power plant. This review is based on the results of most resent investigations made in coal utilizing countries. In many researches it has been noticed that reliable estimation of cost caused by quality changes of coal on utilizability and maintenance of a power plant is a very difficult task, and it is hard to find strait correlation between them. The largest investigations dealing with

coal quality and power plant costs have been published in EPRI's (Electric Power Research Institute) publication series between 1986-1988. The ash and sulphur contents of coal used as fuel in power plants have significant effect on the utilization and maintenance costs of a power plant. These effects may be lowered by cleaning of coal by different ceaning processes before utilization. The reduction of ash content lowers the wear problems and deashing costs of a power plant. The reduction of sulphur content of raw coal has very high importance because of tight emission standards. (19 refs).

26228 (VTT-SYMP-59, pp. 57-77) **Physical bases of IR moisture metering of peat.** Afanas'ev, A.; Arkkipov, G.; Tsvetkov, I. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181-: Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The interaction between radiation and colloid and cappillary-porous materials, which peat systems also belong to, is of great importance for their field drying, for investigating indirect evaluation methods for qualitative characteristics of these materials. Two types of infrared peat moisture meters were developed for the first time in the peat industry: IKVT-2 - for steady and IKVT-II - for field observations of peat moisture content. The devices work on the principle of the registration of IR radiation reflected from the surface layer of moist dispersed material and consequent determination of the moisture content at graduation-diagram. As distinct from existing IR moisture meters (10-12, USSR, Anacon USA, Friske and Hoffner FRG, Francaise Tomson-Hauston France, English IR moisture meters etc.) in our case the multiwave IR method is used (A.C. 949430, USSR). The moisture measuring devices IKVT and IKVT-II differ by the ratio meters. The moisture meter IKVT-II has an analo-to-digital converter, a self-contained power-supply and insignificant mass to mopare with the moisture meter IKVT. The method developed and the devices thus differ favourably from the others. Their main advantage is that they are contactless have a high output and are independet of the readings from the bulk density and temperature of peat.

0108 Waste Management

Refer also to citation(s) 26240, 26242, 26244, 26247

26229 (DOE/PC/88867-T2) **Electrostatic precipitation of condensed acid mist: Second quarterly technical progress report, December 1, 1988-February 28, 1989.** Dahlin, R.S. Southern Research Inst., Birmingham, AL (USA). 1989. 11p. DOE Contract AC22-88PC88867. (SRI-ENV-89-228-6657-8). Order Number DE89010718/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers the project scope and structure for developing and demonstrating a compact, wet electrostatic collector for condensed acid mist in power plant flue gas. In order to accomplish this goal, the objectives to be met are: (1) a laboratory-version of the WESP (Wet Electrostatic Precipitator) must be fabricated, (2) the WESP performance must be optimized through laboratory tests with a nonvolatile simulant aerosol having a size distribution similar to the acid mist, (3) the WESP concept must be proven by demonstrating adequate collection of actual acid mist in a pilot coal combustion facility under conditions simulating a full-scale power plant burning high-sulfur coal, (4) a computer model of the WESP process must be developed to assist in the process optimization, interpretation of test results, and extrapolation to full scale, and (5) utility participation must be solicited in a follow-on demonstration of the WESP concept at a full-scale power plant. Progress in laboratory testing and collection efficiency is described. 5 refs., 2 figs.

26230 **Exhaust gas clean up process.** Walker, R.J. To Dept. of Energy. USA Patent Application 7-207,562. 16 Jun 1988. 28p. Order Number DE89010800/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A method of cleaning an exhaust gas containing particulates, SO_2 and NO_x is described. The method involves prescrubbing with water to remove HCl and most of the particulates, scrubbing with an aqueous absorbent containing a metal chelate and dissolved sulfite salt to remove NO_x and SO_2, and regenerating the absorbent solution by controlled heating, electrodialysis and carbonate salt addition. The NO_x is removed as N_2 gas or nitrogen sulfonate ions and the oxides of sulfur are removed as a valuable sulfate salt. 4 figs.

0109 Environmental Aspects

Refer also to citation(s) 26249

0120 Mining

26231 (NP-9764598) **Detection of subsurface cavities using geoelectric methods.** Elsen, R. Bochum Univ. (Germany, F.R.). Inst. fuer Geophysik. 9 Nov 1987. 177p. (In German). Order Number DE89764598/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

Berichte des Instituts fuer Geophysik der Ruhr-Universitaet Bochum. Reihe A.; no. 24.

An optimized field technique is presented which, in combination with special measuring set-ups and suitable programs for model calculations, permits detailed anomaly analyses. The techniques can be modified for different cavity types and dimensions common of the Ruhr district. Maps with large profile length can be drawn up by this apparatus. The measuring procedure, evaluation and interpretation is presented for five selected examples.

26232 (NP-9764599) **Reduction of rock caving in the face by an improved forepoling technique (slide bar).** Adamek, R. Ruhrkohle A.G., Essen (Germany, F.R.); Bergbau A.G. Westfalen, Bergkamen (Germany, F.R.). Bergwerk Monopol; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1986. 2p. (In German). Order Number DE89764599/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

In order to reduce the danger of rock and coal caving in the face, slide bars with hydraulic parallel-run control were developed for a complete face support system, constructed, and installed. The system was well suited for difficult roof conditions. The hydraulic control system was found to be too complex and accident-prone; it was therefore replaced by an electrohydraulic control system. (MOS).

26233 (PB-89-159800/XAB) **Thermal characteristics of energized coal-mine trailing cables. Report of Investigations/1988.** Yenchek, M.R.; Kovalchik, P.G. Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center. 1988. 19p. (BUMINES-RI-9218). Available from NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600253.

The Bureau of Mines conducted research to determine the relationship between current load and temperature rises in coal-mine trailing cables. Six low-voltage, unshielded, portable power cables were continuously and intermittently loaded with direct current of various magnitudes. Temperature rises within and on the cables were measured with thermocouples, and the data were recorded with a computer. Thermal time constants were calculated, which fixed the periods of the duty-cycle tests. Relationships between average temperature at the conductor-insulation interface and current load were established. The steady-state and intermittent currents that produce a 90 C average conductor-insulation temperature were then determined. Comparisons with Insulated Cable Engineers Association (ICEA) steady-state ratings revealed that 10 to 25 percent more current than recommended ICEA ampacities is required to reach rated insulation temperature. Examination of the maximum intermittent temperatures attained showed that autoignition of coal dust and burn injuries to personnel handling the cable would not be concerns if the temperature at the conductor-insulation interface averaged 90 C.

26234 (VTT-SYMP-59) **Control of peat production.** Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. 80p. (CONF-850181-: Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report is a collection of the papers presented in the seminar Control of peat productionin Jyvaeskylae, 16 January 1985. The Domestic Fuel Laboratory of the Technical Research Centre of Finland (VTT) was responsible for staging this event. The seminar formed

part of the co-operation carried on by the working group for peat within the committee for scientific and technical co-operation between Finland and the Soviet Union. Development work on a planning and control system for peat production is fealt to be important both in Finland and in the Soviet Union. With the help of the system it is possible to adapt peat production to varying weather conditions and by this way to raise production capacity. Regulation of the milling thickness emerged as the principal theme. A proposal was made that co-operation between Finland and the Soviet Union should be carried ou in this area.

26235 (VTT-SYMP–59, pp. 33-42) **Peat weather service.** Venaelaeinen, A. (Meteorological Office, Helsinki (FI)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181– : Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Peat production carried out using the present production methods based on the utilization of solar energy is totally dependent on the weather. The weather cannot, but drawbacks caused by bad weather can be reduced with the assistance of weather forecasts. In addition, it is possible to increase production by using weather forecasts. Forecasts broadcast on radio and TV are too general in nature and therefore peat weather service is necessary. In the project a special peat weather service was provided during the summer of 1984 to the peat sites belonging to the producers who took part in the financing. The forecasts were formulated at the aviation weather centres in Tampere, Kuopio and Rovaniemi. Communication with the peat sites was effected using automatic telephone answerers and the videotex system. The weather factors to be predicted were: air temperature, air humidity, wind speed, probability of rain, amount of rain, starting and finishing times of rain, cloudiness and evaporation (for one bog). At the end of the production season in the autumn foreman were asked to give their opinion of the peat weather service. Replies were received from over 30% of the foremen supplied with the service. According to these replies 96,4% of foremen had used peat weather forecasts when planning production and hoped to get the weather service in the future as well. According to the estimated benefit put forward by the foremen, as a consequence of the peat weather service savings in production costs equal to 3-5 times the costs of the service can be made. When also taking into account the increased production due to the peat weather service, the benefits then amounts to as much as 14 times the costs incurred. According to these estimates, the financial benefit which can be achieved as the results of a nationwide peat weather service is several million marks during one summer.

26236 (VTT-SYMP–59, pp. 20-32) **Developing of milled peat production control in Turveruukki Oy.** Ljokkoi, R. (Turveruukki Oy, Rantsila (Finland)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181–: Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Control research on the production of milled peat has as its primary aim the ability to control the peat drying process under different weather and field conditions. Actual development work connected with production control was begun in 1982 with the clear aim of developing and applying in practice a monitoring adn control system complete with measuring equipment which would permit the drying process to be measured indirectly and weather forecasts to be used systematically in the planning of production at each individual peat site. During the 1984 production season development work reached the stage of experimental use. Experiences gained from trial use have been mainly positive and trial use of the manual system can be considered the first step in the application o the system. As regards the measuring technique, it is justified to say that an adequate technical level has already been attained and the correlation of the indirect measuring method with peat drying can be further improved by adjusting the location height of the evaporation meter. On the other hand, calculation of the length of the harvesting cycle requires further research, which from the point of view of practice must be orientated towards control of field conditions and changes in them during the production season. Although the application of the production control system is informative in nature, it is clearly of assistance when deciding how to carry out production. By means of this system iy id possible to achieve financial benefit in the form of lowered production costs and a larger harvest per hectare.

26237 (VTT-SYMP–59, pp. 43-53) **Fundamentals of peat production process control.** Malkov, L. (All-Union Scientific Research Institute for Peat Industry, Leningrad (USSR)); Petrovskij, E. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181– : Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The milled peat production process is liable to be influenced by quite a number of natural variables; the process is not stable and can only be carried on continuously for relatively short periods - usually not exceeding 10-15 days running - under concurrent favourable meteorological and hydrological conditions. It is for this reason that production process control influences the technical and economic indices of peat production. In the present discussion a justification is put forward of the principles for setting up a rational current process control system, the principles being based on the specific features of the milled-peat production method with respect to present-day technology, equipment and control devices as well as to their prospective development.

26238 (VTT-SYMP–59, pp. 54-56) **Mechanized control system for milled peat production.** Milto, N. (Belgorskij Peat Production Plant (USSR)). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181–: Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Harvesting periods and evaporability vary during the production season. Efforts are made to reduce the dependency of the yield on weather conditions by making maximum use of them. In order to achieve these goals the Soviet peat production institute VNIITP is researching control methods for the milled production process. The necessary data is obtained from a meteorological station in the production area which possesses the following equipment: a remote-controlled evaporatior (DIP 200), a rain gauge, an anemometer, a psychrometer, sensors indicating the state of the peat stratum (drying) and similar equipment. The evaporation occurring between operations is calculated on the basis of readings from the various equipment and the average moisture of the peat stratum. Evaporation is forecast, but the predictions do not always prove accurate in practice. In a similar fashion an instruction is passed over the radio to perform the necessary technological operation. The calcutlated milling depth is set, which is at present done manually. For the maintenance of the mechanized control system the production plant possesses a mechanized monitoring system for the amount of peat obtained during the milling cycle and its quality, which registers the quantity of peat harvested during each operating phase of the miller. The milling depth for the next milling cycle can be set on the basis of the results obtained. When the weather conditions are stable the milling depth does not have to be altered often during the production season, but if the weather is unstable the milling depth has to be changed 2-3 times, particularly when using the pneumatic harvesting method.

26239 (VTT-SYMP–59, pp. 8-19) **Control of milled peat production.** Leinonen, A. (Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Kotimaisten Polttoaineiden Lab.). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1985. (CONF-850181– : Seminar on control of peat production, Jyvaeskylae, FI, January 16, 1985). In *Control of peat production.* Order Number DE88757334/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Development work on a control system for peat production has been carried on at the Domestic Fuel Laboratory of the Technical Research Centre of Finland since 1981. The control system has been primarily designed for use with the Haku method. In the system the milling thickness has been taken a constant. It is assumed that turns in the milling layer take place once a day on average and the interval between the different work phases is calculated as a constant of the harvesting cycle's evaporation total. The control

system was drawn up during the summer of 1984 using a microcomputer (figure 3). The set-up also included a line printer for outputting the production programme and an evaporation meter, which was linked up to the microcomputer. It was demonstrated that output can be improved through control of milled peat production. This is based on the correct timing of the work phases as well as taking into account the demands placed on production by weather conditions. However, a significant increase in output is not achieved until it is possible to alter the thickness of the milling layer in line with weather conditions. The length of the period of fine weather as well as the capacity of the site equipment can then be taken into consideration when planning production and the best possible milling thickness can be selected for each type of weather. This will be the aim of research in the future.

0140 Combustion

Refer also to citation(s) 26216, 26222

26240 (CONF-890401–8) **Calculations of the influence of additives on coal combustion deposits.** Blander, M.; Sinha, S.; Pelton, A.; Eriksson, G. Argonne National Lab., IL (USA). 1989. 8p. DOE Contract W-31109-ENG-38. From 197. national meeting of the American Chemical Society; Dallas, TX, US; April 9, 1989. Order Number DE89010697/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The complex chemistry of coal combustion involves hundreds of species in gaseous, solid, and liquid phases, with some of these being solution phases. We have developed new robust calculational techniques capable of defining the total chemistry of coal combustion and of the complex solid and liquid silicate and sulfate solutions involved. The results indicate that coal combustion chemistry is more complex than had been believed and that kinetic factors can enhance fouling and corrosion by liquid condensates. In this paper, we examine the changes in chemistry due to additions of $CaCO_3$ (to desulfurize the gaseous effluents) and of NaCl and $CaCl_2$ (which are recommended as deicers or to increase the conductivity of effluents in electrostatic precipitators). The results reveal the chemical changes due to these additives; these should be important in defining a strategy for making such additions. In addition, we also impose an expected kinetic constraint on the chemical reactions. Such constraints should, ultimately, prove to be very important in real systems. 8 refs., 4 tabs.

26241 (DOE/PC/79909–T1) **Pyrite thermochemistry, ash agglomeration, and char fragmentation during pulverized coal combustion: Quarterly report for the period September 15, 1988–December 15, 1988.** Akan-Etuk, A.; Niksa, S.; Kruger, C.H. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. Feb 1989. 29p. DOE Contract FG22-87PC79909. Order Number DE89010819/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the quarter we developed size classification techniques to generate narrow size fractions of pyrite inclusions, and density classification techniques to control the dispersion of macrovoids and pyrite loading in our synthetic chars. Two methods to prepare pyrite inclusions in the range of 4 to 10 microns were evaluated, wet sieving and sedimentation. The other major development of the quarter was a scheme to control interparticle variations in both the pyrite loading and the porosity of macrovoids, which cannot be adequately controlled during char synthesis. 11 figs., 4 tabs.

26242 (DOE/PC/88859–T2) **Formation and destruction of nitrogen oxides in coal combustion: Fourth quarterly report, October 1, 1988–December 31, 1988.** Chen, Wei-Yin; Lester, T.W.; Babcock, L.M.; Burch, T.E. Louisiana State Univ., Baton Rouge, LA (USA). Feb 1989. 16p. DOE Contract AC22-88PC88859. Order Number DE89010648/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During this quarter we continued to develop improved techniques of using aluminum diaphragms in the chemical shock tube and of analyzing reaction products. Tests with wide ranges of shock pressures have provided a set of baseline data for the proper selection of Al diaphgrams thickness. Our pioneer work on the analysis of trace amounts of NO, NO_2, NH_3, and HCN with gas chromatography/mass spectrometry were concentrated on column selection, and the use of a cold trap at the GC inlet. The down-fired furnace was completed, and initial confirmatory testing began. Several new sections of refractory had to be built because of damage sustained in transit from Kansas State University to LSU. Additionally, the on-line analyzers for O_2, CO, CO_2, and NO_x had to be calibrated and tested under suitable furnace conditions. Finally, the furnace was successfully fired with natural gas/air flames doped with ammonia to assess the potential performance of the sampling system and analyzer under conditions comparable to those to be employed during the second year of the program. 2 refs., 5 figs., 1 tab.

26243 (DOE/PC/88900–T1) **An engineering model for coal devolatilization: Quarterly report, September 15, 1988–December 15, 1988.** Wei Lau, Chun; Niksa, S. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. 1988. 26p. DOE Contract FG22-88PC88900. Order Number DE89010717/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During this reporting period, we concentrated on an engineering correlation to represent the enhanced heat transfer predicted from our analysis of the heat and mass transfer around a devolatilizing coal particle. As explained in the last quarterly report, our analysis does not assume that the free stream conditions are reached at infinity, as in the conventional definitions of the Nusselt number and blowing factors for particles in the pulverized fuel grade. Instead, the extent of the thermal and concentration fields are time-dependent, and assigned to satisfy both mass and energy conservation in the film by adapting recent analyses of vapor accumulation effects (VAE) during fuel droplet evaporation. The complete formulation of the model appears in the last quarterly report. 1 ref., 6 figs.

26244 (DOE/PC/88918–1) **Reduction of NO_x and SO_2 emissions from coal burning pulse combustors: Quarterly technical progress report, September 1, 1988–December 31, 1988.** Powell, E.A.; Zinn, B.T. Georgia Tech Research Corp., Atlanta, GA (USA). Jan 1989. 12p. DOE Contract FG22-88PC88918. Order Number DE89010618/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project is concerned with the reduction of the NO_x and SO_2 emissions from Rijke type pulse coal combustors by using combustion staging and limestone addition. Most of the work accomplished during this period was concerned with the design and fabrication of the Rijke tube combustor, the coal feed system and the limestone feed system. The combustor was designed to be operated in either a 3 m or 6 m long configuration with a fixed coal bed location. The limestone and coal feed systems utilize motor driven augers to deliver the materials at controlled rates. The pulverized limestone feed system was designed to introduce 50 micron limestone particles into an air stream and to inject them just above the coal bed. The design of the major components was completed during the report period, and fabrication of some of these components was begun during the last month of this period. 8 figs.

26245 (STF–15A87044) **Theoretical predictions of char burnoff.** Vareide, D.; Soenju, O.K. Selskapet for Industriell og Teknisk Forskning, Trondhaim (Norway). Sep 1987. 45p. Order Number DE88757328/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Phenomenologically, char particles burn in a manner somewhere between two extremes: in a constant size mode or a constant density mode. Based on this, two idealized models for the prediction of char burnoff have been developed: a progressive conversion model and a shrinking particle model. Pertinent results from the model predictions are presented, including total burnout time versus particle size, gas temperature, and oxygen concentration, which are the main parameters affecting the burnoff of char particles. Chemical kinetic control is dominant for small particle sizes, low gas temperature, and low oxygen concentrations. A maximum particle temperature is predicted for a certain particle size at given condition. This maximum particle temperature can exeed the gas temperature by several hundred Kelvins. The constant size model exhibits a multiplicity of solutions for total burnout times versus particle size, i.e. up to three particle sizes can have the same burnout time. This feature is only seen for large oxygen concentrations. 17 drawings.

26246 (TKK-KO/ET–28) **Particle removal from the flue gases of a pressurized fluidized bed combustor.** Hulkkonen, S. Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering. Nov 1988. 248p. (In Finnish). Order Number DE88757330/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The purpose of the study is to examine flue gas clean-up at pressurized fluidized bed combustion (PFBC). In the beginning of the report the requirements for gas clean-up are discussed and different clean-up devices and development work carried out are reviewed. Finally the results obtained at the PFBC/G test rig of TKK/VTT/IVO are presented. One of the most difficult problem in pressurized fluidized bed combustion is hot gas clean-up and erosion of the gas turbine lifetime. In addition to requirements set by the gas turbine the environmental standards need to be fulfilled. High temperature, high pressure gas clean-up devices have been tested and developed in the world already quite a long time. Commercial and reliable system, however, is not yet available. The objects of the research have been different kinds of cyclones, barrier filters, granular bed filters and electrostatic precipitators. Cyclone is considered to be sufficient for meeting the gas turbine limits but for environmental regulations additional cleaning is needed. This can be realized either after the gas turbine using conventional techniques or before the gas turbine at high temperature and pressure. Gas cleaning at high temperature and pressure is preferred. The most promising devices for hot gas clean-up appear to be ceramic barrier filters and electrostatic precipitator.

26247 **Cofiring of pelletized refuse-derived fuel with coal to achieve sulfur dioxide emissions requirements.** Ohlsson, O.O. (Argonne National Lab., Argonne, IL (US)); Pearson, C.V.; Lazar, J. pp. 219-220 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

Recent success in the processing of municipal solid waste with lime additives to produce a high quality, storable, fuel-pellet have given impetous to cofiring these pellets with Illinois or Kentucky coals in order to reduce sulfur dioxide emissions. Based on earlier studies on the efficacious effect of lime addition to coal and analysis of cofiring lime-rich RDF pellets with coal to achieve the same results, a series of burn-tests are in progress at the Argonne National Laboratory to verify the rate and conditions for optimum sulfur capture. RDF-pellets with lime additions of 4 to 10 weight percent have been fired with coal at ratios of 10, 20 and 30 percent RDF by heat input are being tested. This paper presents the results to date.

26248 **Transient group combustion.** Ramalingam, S.C. (Texas A and M Univ., College Station, TX (US)); Annamalai, K. pp. 492-499 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

While most of the experiments are performed with a cloud of particles, the theoretical modelling used to compare and interpret the experimental data based on the modelling of combustion of individual coal particles. As opposed to individual particle modelling, a group theory is proposed for the combustion modelling of char/carbon particles. To gain a basic understanding of the group behavior, a simple model such as the analysis of a spherically symmetric cloud of char/carbon particles burning in quiescent air, is presented here. Each particle within the cloud produces CO due to both the oxidation of C to CO and the reduction of CO_2 to CO which subsequently oxidizes to CO_2 in the homogeneous gas phase. Using a computer code developed for the study of transient group combustion, steady state was simulated. Firstly, the simulated steady state results were then compared with the explicit results generated in the previous work. The results presented here are for the frozen case where the gas phase CO oxidation reaction and the CO_2 reduction reaction at the char surface are suppressed. This task was undertaken to prove the reliability of the computer model to generate transient results, as there exists no literature on transient group combustion. Secondly, the transient results for G = 100 and G = 10 are also included to show the comparison with the steady state results for the same conditions.

26249 **Kinetics and mechanism of the reaction of nitric oxide with bound carbon at flame temperatures.** Kirsch, M.J. (Louisiana State Univ., Baton Rouge, LA (US)); Cheng, M.T.; Lester, T.W. pp. 400-405 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

The present study is being conducted to evaluate the global rates of the reaction of NO with carbon black particulates at flame temperatures. Carbon black suspensions are heated behind the reflected shock wave in a single-pulse shock tube. Experiments are tailored such that reflected shock pressures are approximately two atmospheres while reflected shock temperatures are varied over 1500 - 2000 K. A method was developed for aspirating the carbon black into the test section of the shock tube. Post-shock gas samples are analyzed by gas chromatography using a method developed in this study. The rate of NO consumption, -d[NO]/dt, is used to define an intrinsic rate constant κ, which is based on the B.E.T. surface area of the carbon black. Based on the ratio of CO/CO_2 in the products, a mechanism for the reaction of NO with bound carbon is postulated.

0150 Marketing and Economics

Refer also to citation(s) 26624

26250 (PB–89-152748/XAB) **Market guide for steam-coal exports from Appalachia. Appendix B: detailed country data and maps.** ICF, Inc., Fairfax, VA (USA). Mar 1982. 80p. Available from NTIS, PC A05/MF A01.

This publication is Appendix B to Market Guide for Steam Coal Exports from Appalachia (March 1982) which is part of the series titled Steam Coal Exports from Appalachia. It contains a series of tables delineating utility and cement plant locations, net dependable capacity (MW), and net generation for the United Kingdom, France, Italy, West Germany, The Netherlands, Belgium/Luxembourg, Denmark, and Spain. It reports the steam-coal import demands from 1979 or 1980 for each country.

26251 (PB–89-152755/XAB) **Steam-coal import requirements in Turkey, Egypt, Finland, and Israel: supplemental summary report to international steam coal trade analysis. (from the series market guides for steam coal exports from Appalachia).** ICF, Inc., Fairfax, VA (USA). Dec 1982. 30p. Available from NTIS, PC A03/MF A01.

See also PB–89-152748.

This publication provides a review of the potential steam coal import demand for Turkey, Egypt, Finland, and Israel for 1985, 1990, and 1995. It summarizes and documents the readily available information about the issues related to steam-coal imports to the four countries. The effort was limited in scope and resources and should not be viewed as a definitive analysis.

0160 Health and Safety

Refer also to citation(s) 26233

26252 (PB–89-162010/XAB) **Federal coal mine health program in 1972. Annual report.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 1973. 56p. Available from NTIS, PC A04/MF A01.

See also PB–83-139410.

This annual report describes the activities of NIOSH in 1972 in meeting its responsibilities under the Federal Coal Mine Health and Safety Act of 1969. Efforts were made to complete the verification of the interpretations of the first round of medical examinations of coal workers as required in the Act. A preliminary study was initiated to assess the prevalence of coal workers pneumoconiosis (CWP) in surface-coal-mine workers and a total of 1,323 men at six mines was examined. The major emphasis of research in 1972 was directed to the NIOSH Appalachian Laboratory for Occupational Respiratory Diseases located in Morgantown, West Virginia. The

program includes clinical and physiological investigations of cardiopulmonary function, pathological examinations of diseased lungs, investigations of the role of infectious disease in the development and progression of CWP, biochemical investigations to detect the earliest effects of CWP at the cellular level, and epidemiological studies to identify the various factors concerned in the production of disease and to quantify their effects.

26253 (PB–89-165195/XAB) **Occupational safety and health implications of increased coal utilization.** National Inst. for Occupational Safety and Health, Rockville, MD (USA). Dec 1977. 48p. Available from NTIS, PC A03/MF A01.

The health and safety record in underground and surface coal mines, and in coal-fired power facilities were reviewed in order to estimate the effects of potential increases in coal utilization. Studies have indicated that underground-coal miners have experienced increased mortality from occupationally induced lung disease and accidental deaths; there may also be increased mortality from stomach cancer. Occupationally induced hearing loss was commonly found in underground miners. Longwall mining and the use of diesel-powered mining equipment were mining technologies in increasing use which may present additional health hazards. Surface miners have experienced less respiratory disease than underground miners, and noise has been less of a hazard in surface mines. Exposure to heat and cold presented hazards in surface mining which may be amenable to control technology. Studies among workers in coal-fired power facilities indicated that exposures to noise, heat, coal dust, asbestos, fly ash, and sulfur dioxide were potential problems. The authors conclude that without strong preventive measures, increasing coal production cannot be achieved without incurring additional costs in occupationally induced disease, job-related disabling injuries and accidental deaths.

02 PETROLEUM

0201 Reserves

Refer also to citation(s) 26282

0202 Geology and Exploration

26254 (EGG-BEG–8318) **Basic mechanisms in the biochemical modification of tars, heavy oils, and kerogen: FY-1988 progress report.** Hatcher, H.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). Nov 1988. 31p. DOE Contract AC07-76ID01570. Order Number DE89011116/JAW. Available from NTIS, PC A03 - OSTI.

Samples of TOK material were collected from the Green River Formation. Twenty-three different forms of bacteria were isolated from the samples; nine of the isolates were capable of utilizing hydrocarbons of the type found in the samples. Lipid patterns of the isolates are being investigated by several chromatographic/spectrometric methods for identification purposes. Pyrolysis GC/MS studies indicate that oil shale may be the progenitor of hydrocarbon-containing rocks and petroleum. 4 refs., 13 figs., 3 tabs.

26255 (NSRL–1988) **Nova Scotia Resources Limited. 1988 annual report.** Nova Scotia Resources Ltd., Halifax, NS (Canada). 1988. 17p. (MICROLOG–89-00797). Available from Nova Scotia Resources Limited, 1657 Bedford Row, PO Box 2111, Stn. M, Halifax, NS, Canada B3J 3B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual report deals with the financial achievements of the company. During 1987/88, the company also initiated or participated in three exploratory/appraisal wells in the Sable Island region: Whycocomagh N-90, Como P 21, and Panuke F99, which yielded promising results. The report discusses Scotian shelf oil prospects, exploration agreement number 283 (south and west of Sable Island), the Cohasset-Panuke project, and the Venture Gas project. Other activities described are gold exploration and the testing of new coal-water fuels. The financial statements of the company as at March 31, 1988 are given. 5 figs., 3 tabs.

26256 (PRI–1981-6) **Methods of in-situ saturation determination during core tests involving multiphase flow.** Saraf, D.N. Petroleum Recovery Inst., Calgary, AB (Canada). 1981. 21p. (CE–02513). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents a review of various methods available for measuring fluid saturations in cores during multiphase fluid flow. As part of a project on three-phase (oil-water-gas) flow, it was decided to critically examine all of the available in-situ saturation methods and to identify those that appear to have the best potential for measuring three-phase saturation. Microwave attenuation and phase shift, and bienergetic gamma-ray absorption methods were judged as having the greatest potential in terms of versatility and accuracy. Each of these measurement methods may permit the estimation of saturations of two of the three phases present. 65 refs.

0203 Drilling and Production

Refer also to citation(s) 26272

26257 (CONF-881205–2) **Microbial enhancement of oil recovery.** Misra, A.K.; Watson, J.S. Oak Ridge National Lab., TN (USA). 1988. 16p. DOE Contract AC05-84OR21400. From Gas, oil and coal biotechnology symposium; New Orleans, LA, US; December 5, 1988. Order Number DE89011243/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is principally based on the results of an assessment of research and development needs and opportunities in microbial enhanced oil recovery (MEOR) which was prepared by one author, and on recent experimental work (led by the other author) that begins to explore some facets of the problems identified in the assessment. 31 refs.

26258 (DOE/BC/14014–9) **Microbiological techniques for paraffin reduction in producing oil wells: Final report.** Oppenheimer, C.H.; Hiebert, F.K. Alpha Environmental Corp., Austin, TX (USA). Apr 1989. 68p. DOE Contract FG22-86BC14014. Order Number DE89000741/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Alpha Environmental has completed an eighteen month field oriented, cooperative research program with the US Department of Energy to demonstrate a new economically viable process using petroleum degrading microorganisms, a biocatalyst, formation water and inorganic nutrients to recover residual oil from reservoirs. Alpha's mixed community of microorganisms decomposes crude oil to produce detergents, CO_2, and new cells, thus mechanically and chemically releasing oil from reservoir pores. The naturally-occurring bacteria utilized in this project were previously selected by screening and isolating microorganisms from soils contaminated with crude oil and petroleum products. The activity and level of salt tolerance (to 20% salinity) of the bacteria is enhanced by a biocatalyst, previously developed by Alpha Environmental. Field evidence suggests that the biocatalyst provides catalytic oxygen to the microorganisms in the reservoir, which augments low levels of in-situ molecular oxygen. 25 refs., 10 figs., 6 tabs.

26259 (DOE/FE/61114–1) **Development of Alaskan fossil energy resources: Part 1, Development of effective gas solvents including CO_2 for the improved recovery of West Sak oil: Second annual report, October 1, 1987–September 30, 1988.** Roper, M.; Siddiqui, N.; Ostermann, R.D. Alaska Univ., Fairbanks, AK (USA). Petroleum Development Lab. 31 Oct 1988. 226p. DOE Contract FG21-86FE61114. Order Number DE89010932/JAW. Available from NTIS, PC A11 - OSTI.

Research on miscible displacement of West Sak oil is described. The following tasks were performed: Task 1, laboratory measurement of phase behavior and physical properties of West Sak oil–solvent mixtures. Task 2, measurement of minimum miscibility pressure for enriched gas solvents–West Sak crude mixtures. Task 3, prediction of phase behavior and miscibility conditions for West Sak crude–solvent mixtures. Task 4, displacement experiments on steam–solvent process for West Sak oil. Task 5, displacement studies on steam–solvent injection for heavy oil recovery and application

to West Sak reservoir: development of a heat transfer model. 14 figs., 5 tabs.

26260 (NIPER–408) **Correlation of laboratory design procedures with field performance in surfactant-polymer flooding.** Lorenz, P.B. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Feb 1989. 30p. DOE Contract FC22-83FE60149. Order Number DE89010670/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As an aid in assessment of laboratory procedures for optimizing surfactant and polymer flooding systems, a survey is presented of field tests whose performance has been well documented and analyzed. The reasons for failure to attain predicted recovery are summarized: reservoir heterogeneity, loss of injectivity and mobility control, incomplete determination of surfactant and polymer characteristics under changing conditions, neglect of ion-exchange effects and the presence of gypsum, unrealistic evaluation of surfactant retention, inaccurate residual oil values, and emulsification. Statistical analysis indicates that surfactant concentration and the size of surfactant and polymer slugs are the most important factors in oil recovery by surfactant-polymer flooding. Recommendations are made on how design procedures can be extended and improved, with an emphasis on laboratory programs. 52 refs., 1 fig., 2 tabs.

26261 (PB–89-160162/XAB) **Forest Hill Heavy Oil Project, quarterly environmental report: second quarter, April 1-June 30, 1988.** Greenwich Oil Corp., Dallas, TX (USA). 22 Sep 1988. 121p. (OSFP/FH–0012). Available from NTIS, PC A06/MF A01.

See also PB–89-109052 and PB–89-146245.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Forest Hill Heavy Oil Project is one of the four projects awarded financial assistance. The Project agreed to comply with existing environmental-monitoring regulations and to develop an Environmental Monitoring Plan incorporating supplemental monitoring in the areas of water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1985-1991. The Forest Hill Heavy Oil Project site outside Quitman, Texas, extends three miles over the Harris Sand formation. Air-injection wells for air injection and fireflooding are located throughout the field. The report presents production data and environmental-monitoring data for commissioning and indicator parameters derived during the second calendar quarter of 1988.

26262 (PRI–1981-1) **Numerical simulation of laboratory steamflood experiments.** Hayashitani, M.; Davis, W.; Novosad, J.; Batycky, J.P. Petroleum Recovery Inst., Calgary, AB (Canada). 1981. 33p. (CE–02471). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objective of this work was to define and to evaluate the capabilities and limitations of the INTERCOMP numerical steamflood simulator and a scaled steam flood physical model. Three different types of labooratory experiments were selected for numerical history matching: waterflood, hot-waterflood and steamflood. It was intended to match oil, water, and steam production as well as the energy balance and the temperature profiles using a single set of physical and petrophysical parameters. In addition, sensitivity studies were computed for three different grid systems, specifically a coarse cross-sectional grid, a fine cross-sectional grid, and a three-dimensional grid. Excellent matching was obtained for the fluids production and for the energy balances. However, some difficulties were encountered during attempts to match some of the temperature profiles, especially those associated with the flow of hot water along the bottom of the reservoir. As a result of the simulations, new measurements of thermal conductivity between the model and the underlying concrete bed were performed. A more complete interpretation of the physical model was obtained. The results indicate that physical model experiments offer useful data which can enable testing and calibration of numerical models while the latter can help in obtaining a more precise description of the former. Therefore, the physical and numerical models should be used in a mutually complementary manner. 17 refs., 12 figs., 4 tabs.

0204 Processing

26263 (EPRI-GS–6357) **Coal-oil coprocessing: Phase 2: Final report.** Duddy, J.E.; Smith, T.O.; Harris, E.C. Electric Power Research Inst., Palo Alto, CA (USA); Hydrocarbon Research, Inc., Lawrenceville, NJ (USA). Apr 1989. 215p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the results of Phase 2 of the Coal/Oil Coprocessing Program. Phase I of the Coal/Oil Coprocessing Program evaluated the technical, economic and commercial feasibility of coal/oil coprocessing. Results of Phase I were reported previously and key results are highlighted in Section 2 of this report. Phase 2 of the Coal/Oil Coprocessing Program was directed towards demonstration of the HRI Coal/Oil Coprocessing Technology at preferred commercial operating conditions, expansion of the feedstock data base and improved process understanding. The key element of this Coal/Oil Coprocessing Program is the continuous bench-scale operation at HRI. In Phase 2, two bench-scale operations were completed, Bench Run No. 1–Process Demonstration and Bench Run No. 2–Alternative Feedstocks. Results of these bench-scale operations are presented. 10 refs., 48 figs., 61 tabs.

0205 Products and By-products

Refer also to citation(s) 26809, 27066

0206 Health and Safety

Refer also to citation(s) 27666, 27667

0207 Marketing and Economics

Refer also to citation(s) 26624

26264 (CMI-R–862310-2) **Reservoir economics.** Wallace, S.M.; Helgesen, C. Christian Michelsens Inst. for Vitenskap og Aandsfrihet, Bergen (Norway). Apr 1986. 56p. (In Norwegian). Order Number DE88757289/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

This is the final report of the project "Reservoir Economics". The purpose is to analyze the coupling between economics, reservoir properties and development technology. The report describes the resulting model and several different applications. 16 refs., 23 figs.

26265 (DOE/EI/20470–T1) **Maine Office of Energy Resources 1987–1988 distillate price and inventory monitoring program: Final report.** Maine State Government, Augusta, ME (USA). 1989. 9p. DOE Contract FC01-87EI20470. Order Number DE89010492/JAW. Available from NTIS, PC A02 - OSTI.

The Maine Office of Energy Resources has completed a heating season of monitoring prices and stocks for the State of Maine. The office has been surveying residential home heating prices since 1977. In 1979, OER began collecting data on inventory levels and rack prices. Reporting of distillate stocks and deliveries is authorized by Maine Public Law Chapter 372. The established process calls for bi-weekly reports to be filed with the Maine OER within fifteen days of the first and third Mondays of each month. In Maine, twelve companies come under the definitions of the law as handling distillate petroleum products, with two additional companies transporting only residual oils. As part of a grant provided by the US Department of Energy, wholesale and retail price information was gathered throughout the 1987–88 heating season—September through April. The survey procedure, including the identification of thirty representative dealers, was established by DOE in an Energy Information Agency program, which involved data collection in 14 states. This season, surveys were performed twenty-five times between September 21, 1987 and May 1, 1988. Frequency changed from bi-weekly to a weekly basis after November 30, 1987, until reverting back to a bi-weekly procedure for the months of March and April. 5 figs.

26266 (DOE/EIA–0520(89/04)) **International petroleum statistics report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 25 Apr 1989. 45p. Order Number DE89010756/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports, and stocks. The report has three sections: Section 1 contains time series on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1973, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e., non-Communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data beginning in 1982, and quarterly data for the most recent two years. 23 tabs.

26267 (DOE/PE/79013–H1) **OPEC and lower oil prices: impacts on production capacity, export refining, domestic demand and trade balances.** Fesharaki, F.; Fridley, D.; Isaak, D.; Totto, L.; Wilson, T. East-West Center, Honolulu, HI (USA). Resource Systems Inst. Jan 1989. 151p. DOE Contract FG01-87PE79013. Order Number DE89010660/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The East-West Center received a research grant from the US Department of Energy's Office of Policy, Planning, and Analysis to study the impact of lower oil prices on OPEC production capacity, on export refineries, and the petroleum trade. The project was later expanded to include balance-of-payments scenarios and impacts on OPEC domestic demand. The Department of Energy requested that the study focus on the Persian Gulf countries, as these countries have the largest share of OPEC reserves and production. Since then, staff members from the East-West Center have visited Iran, the United Arab Emirates, and Saudi Arabia and obtained detailed information from other countries. In addition, the East-West Center received from a number of large international oil companies and national governments valuable information on OPEC production capabilities. In order to safeguard the confidential nature of this information, these data have been aggregated in this report. The East-West Center considers the results presented to be the most up-to-date information and analysis available today. This report also provides a major reassessment of the export refining and economic competitiveness of Middle East refineries. As pioneers of the research on OPEC export refineries, the East-West Center has fully reevaluated the performance and outlook of these refineries as of the present. 21 figs., 20 tabs.

26268 (GCR–1988) **Gulf Canada Resources Ltd. annual report, 1988.** Gulf Canada Resources Ltd., Calgary, Alberta. 1989. 52p. (CE–02588). Available from Gulf Canada Resources Limited, Investor and Public Affairs Division, PO Box 130, Calgary, AB, Canada T2P 2H7; $N/C.

Gulf Canada Resources Limited is a major explorer and producer of oil and natural gas. Areas of activity are Western Canada, the Beaufort Sea, the Newfoundland offshore, and four countries outside of North America. The company also operates gas processing plants and pipelines, and participates in oil sands projects in Alberta and a coal mine in British Columbia. This report reviews the company's activities over the year, providing descriptions of Canadian and international operations along with financial statements and associated information. Some highlights included a 21% increase in gas sales from Western Canada to 340 million cubic feet per day, and the acquisition of Asamera Inc. and HPC Inc., which extended the company's areas of operation to the USA and Indonesia.

26269 (MOG–1987) **Manitoba oil and gas corporation annual report, 1987.** Manitoba Oil and Gas Corp., Winnipeg, MB (Canada). 1987. 18p. (MICROLOG–89-00123). Available from Manitoba Oil and Gas Corporation, 870-330 Graham Ave., Winnipeg, MB, Canada R3C 4A5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Manitoba Oil and Gas is a Crown corporation established in 1983 to participate in the development of the province's oil and gas resources through direct participation in oil and gas exploration and development, and to achieve corporate profitability. This annual report for the calendar year 1987 presents financial and operating highlights of the year compared to the previous 3 years, with detail on the activities of the corporation in exploration and development, and production and reserves. A financial statement is included. 5 figs., 2 tabs.

0208 Waste Management

Refer also to citation(s) 26305

0209 Environmental Aspects

Refer also to citation(s) 27316, 27319

26270 (DA–95) **Evaluation of hovercraft for dispersant application.** Dickens, D.; Belore, R.; Buist, I.; Humphrey, B. Dickins (D.F.) Associates Ltd., Vancouver, British Columbia (Canada); Ross (S.L.) Environmental Research Ltd., Ottawa, Ontario (Canada); Sereda, Marsh and Associates Ltd., Edmonton, Alberta (Canada). 1988. 57p. (MICROLOG–89-00751). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A series of field trials were carried out in Vancouver, Canada in July and August 1986 to determine whether or not hovercraft should be considered for dispersant application. Questions are: the ability of the hovercraft to "fly" over an oil slick at high speed without displacing the oil out of the path, the potential for using the hovercraft to impart vertical mixing energy into the water column to aid in the dispersant process and, the ability to mount a suitable spray boom and obtain a uniform spray pattern across the swath width. The field trials and subsequent interpretation of results provide positive answers to the first and second question. The question of mixing energy requires some qualification. The hovercraft contributes considerable mixing energy to the immediate water surface through air entrainment but this effect is short lived and there does not appear to be significant long term vertical mixing in the hovercraft wake. Recommendations are made for operating procedures and boom mounting which should ensure a uniform drop size and dose rate across a swath up to 18 m. The cushion air escaping from around the craft perimeter is not an important factor in adversly affecting the dispersant spray pattern. Depending on the type of machine available, hovcercraft have the capability of treating up to a $1km^2$ slick between loads, at average speeds in the 15 to 25 knot range. The inherent advantages of high transit speed to the site (up to 45 Knots), amphibious operation (i.e. not draft limited) and lack of ceiling or visibility restrictions provide hovercarft with unique capabilities in the dispersant application role. Two patents relating to the process have been abstracted. Appendix B gives the sprecifications of two different models of hovercrafts. 14 refs., 29 figs., 6 tabs.

26271 (NIVA-O–86095) **Biotechnology, degradation and mitigation of offshore oil spills.** Bakke, T.; Briseid, T.; Eidsaa, G.; Nordgaard, E. Norsk Petroleumsinstitutt, Oslo (Norway). Dec 1986. 19p. (SI–860615). Order Number DE88757318/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The report summarizes the results of Phase 1 of the project which aimed to outline the present knowledge in the field of enhanced biodegradation of oil, and recommends further research. It is based on three subreports treating (1) chemical oil combat methods, (2) biodegradation of oil in general, and (3) proposed ecosystem experiments to tests effectivity and ecological effects of stimulated biodegradation. To develop biodegradation technology it is recommended to pursue ideas about combining dispersants and demulsifiers with oil soluble fertilizers, the use of filamentous fungi and bacteria in combination with sorbents, and matrices impregnated with microorganisms and nutrients.

26272 (PB–89-146252/XAB) **Forest Hill Heavy Oil Project. Annual environmental report 1988, Rept. for 1 October 1987-30 September 1988.** Forest Hill Co., Dallas, TX (USA). 16 Dec 1988. 116p. Available from NTIS, PC A06/MF A01.

See also PB–89-146245.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Forest Hill

Heavy Oil Project is one of the four projects awarded financial assistance. This Project agreed to comply with existing environmental-monitoring regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in the areas of water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1985-1991. The Forest Hill Heavy Oil Project site outside Quitman, Texas extends three miles over the Harris Sand formation. Wells for air injection and fireflooding are located throughout the field. This document summarizes progress in environmental monitoring relative to operating in full compliance with all federal and local regulations and in requirements of the Commitment to Guarantee with the U.S. Department of Treasury.

26273 (PB–89-147144/XAB) **Chemical and biological monitoring in Sullom Voe, 1987.** Westwood, S.S.C.; Howells, S.E.; Smith, J. Field Studies Council, Pembroke (UK). Oil Pollution Research Unit. 1988. 143p. (FSC/OPRU–2/88). Available from NTIS, PC EE07/MF E07.

See also report for 1986, PB–88-146048.

This report describes the results of the tenth chemical and macrobenthic monitoring survey carried out in twenty-four stations in Sullom Voe, Calback Ness, Garths and Orka Voes to provide a quantitative description of the sublittoral benthic macrofauna. Sediment samples were taken at all 24 stations plus an additional two stations in Orka Voe for analyses of hydrocarbons, organic carbon and nitrogen, percentage combustibles, and sediment grain size. Samples of sediment along transects from high to low water at 3 soft shores were taken for hydrocarbon and grain size analyses. Additional samples were obtained from the main loading jetties, the Orka Voe shoreline and Crooksetter Burn to aid in interpretation of hydrocarbon data from these regions.

26274 (PB–89-147763/XAB) **Surveys of rocky shores in the region of Sullom Voe, Shetland, August 1987.** Howson, C.M. Field Studies Council, Pembroke (UK). Oil Pollution Research Unit. 1988. 32p. (FSC/OPRU–4/88). Available from NTIS, PC EE05/MF E05.

See also PB–88-146030.

Following an assessment of the results of annual rocky shore surveys in the region of Sullom Voe from 1976 to 1981, it was recommended that experienced biologists undertake a field check of all rocky shore transects there in August of each year. This report summarizes the work undertaken during August 1987. During a period of low spring tides, 23 of the primary monitoring sites in the region of Sullom Voe were visited. The transects were relocated, the abundance of species present at each station compared with 1981 data sheets, and any differences noted. Photographs were taken of each transect, of adjacent rocky areas and of features considered of interest. In addition, the entire shoreline of Sullom Voe was inspected, either from a boat or by walking between sites, and any features considered unusual noted. The presence of oil on or around the transects was recorded by John Shears. The majority of transects were remarked at the top with a yellow stake to aid their relocation.

26275 (SI-R–861101-1) **Oil spill consequences. Localization of oil protection depot in the North West country.** Seip, K.L.; Ryssdal, J. Senter for Industriforskning, Oslo (Norway). May 1987. 69p. (In Norwegian). Order Number DE88757326/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Localizing an oil protection depot to Aalesund or Maaloey will give about the same oil protection efficiency. The two alternatives are compared regarding the frequency of oil spills along the North-Western coast and the distribution of oil spill exposed resources: Shores, birds, recreation sites, properties, business and fisheries. Without oil pollution abatement the damages will increase 2 to 5 times compared to damages after protective actions. 52 drawings, 6 pictures, 31 tabs.

26276 (STF–A86053) **Effects of oil and dispersant on the germination and growth of Festuca rubra and Trifolium repens.** Klokk, T. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Jun 1986. 15p. Order Number DE88757329/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The effects of oil and dispersent on seed and the vegetative growth of red fescue (Festuca rubra) and white clover (Trifolium repens) were investigated. The test oil was a weathered crude oil from the Statfjord field in the North Sea. The dispersant tested was Finasol-OSR-4. The experiment includes three pollution levels, corresponding to 0.3 lm^{-2} and 3.0 lm^{-2}respectively. The three pollution series were oil, oil disapersant (1:|), and dispersant. All pollution levels gave a reduction in the germination frequence and vegetative growth (here expressed as the dry veight of the net production above ground). The oil and oil/dispersant resulted in a greater reduction in germination and growth than the dispersant. 2 tabs., 10 drawings.

0210 Legislation and Regulation

Refer also to citation(s) 26267

26277 (BCMAF/FR–8804) **Surface rights in British Columbia. A guide to the legislation and regulations for the petroleum and natural gas industry.** Sasaki, H. British Columbia Ministry of Agriculture and Fisheries, BC (Canada). Farmland Resources Branch. 1988. 18p. (MICROLOG–89-00640). Available from British Columbia. Ministry of Agriculture and Fisheries, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this guide is to outline the petroleum and natural gas exploration and production process as it relates to the property rights of a landowner, in particular to surface rights, right-of-entry, and mediation and arbitration. It provides guidance to the legislation and regulations governing the petroleum and natural gas industry in British Columbia. The topics covered are: land ownership rights, terminology, and the Petroleum and Natural Gas Act (surface rights, seismic permit, surface lease, easement agreement, mediation and arbitration, mediation, right-of-entry, arbitration, certificate of restoration). The relevant legislation is listed, standard forms are described and a bibliography on the subject of surface rights is given. 25 refs.

0230 Properties

Refer also to citation(s) 26828

26278 Identification of fluids and an interface between fluids. Lee, D.O.; Wayland, J.R. Jr. To Dept. of Energy. USA Patent Application 7-166,343. 10 Mar 1988. 15p. DOE Contract AC04-76DP00789. Order Number DE89010815/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Complex impedance measured over a predefined frequency range is used to determine the identity of different oils in a column. The location of an interface between the oils is determined from the percent frequency effects of the complex impedance measured across the interface. 4 figs.

0240 Storage

Refer also to citation(s) 26278

0250 Combustion

26279 A theoretical study of the rate constant for the addition of atomic hydrogen to acetylene. Duchovic, R.J. (Argonne National Lab., Argonne, IL (US)); Wagner, A.F.; Garner, D.M.; Flemming, D.G. pp. 153-156 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

The effort to understand the mechanism of combustion and high temperature pyrolysis has been and continues to be a major focus of both experimental and theoretical chemical kinetics. In particular, the study of hydrocarbon combustion reactions has played a key role in these efforts. It is well-known that atomic hydrogen is a crucial intermediate in the chemistry of all hydrocarbon flames. consequently, a thorough understanding of reactions which either consume of produce atomic hydrogen is critically important to the success of these investigations. Those chemical processes which

involve the addition of atomic hydrogen to unsaturated hydrocarbons constitute one important class of such reactions. Over the past forty years, a number of theoretical and experimental studies have investigated the addition of atomic hydrogen to both acetylene and ethylene. These studies have identified a serious disagreement between the experimental data and the theoretical interpretation of those data.

03 NATURAL GAS

26280 (PB–89-161368/XAB) **Gas Research Institute review of basic sciences research, 1979-1986.** Gas Research Inst., Chicago, IL (USA). May 1987. 72p. (GRI–87/0370). Available from NTIS, PC A04/MF A01.

See also PB–89-161376.

Eight years of Gas Research Institute (GRI) Basic Sciences research (conducted through 325 contracts) is described under 32 program elements grouped according to GRI's overall R&D objectives: Gas Supply, End Use, Gas Industry Operations, and Crosscutting Research. Each program element review includes: actual expenditures and documented coordinated funding, reasons for investing in the research, research goals, technical approach, key results, and future plans.

26281 (PB–89-161376/XAB) **Gas Research Institute review of basic sciences research, 1987.** Gas Research Inst., Chicago, IL (USA). May 1988. 41p. (GRI–88/0359). Available from NTIS, PC A03/MF A01.

See also PB–89-161368.

This review refers to a 1987 publication (report GRI-87/0370) which describes eight years of Basic Sciences research. The 1988 version indicates changes that occurred during 1987, including research that ended, changes in active research, and new topics.

0301 Reserves

26282 (BCMEMPR–1987) **Hydrocarbon and by-product reserves in British Columbia, 1987.** British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria (Canada). 1987. 204p. (MICROLOG–89-00815). Available from Petroleum Resources Division, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $40.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents the oil, gas, and by-product reserves in British Columbia as at December 31, 1987, estimated by the Engineering and Operations Branch of the Ministry of Energy, Mines and Petroleum Resources. During 1987, the Ministry substantially revised PANG, a well production history data base, to further improve data filing capabilities. As a result, it became possible to correct a number of errors in the pre-1960 part of the historical production records. No significant impact was noticeable on reserves. A summary of year-end remaining established reserved is presented, in imperial units and S.I. units respectively. Since a substantial portion of remaining reserves are in unconnected gas pools, these are separately summarized by plant gathering area. The established reserves of oil were 19 x $10^6 m^3$ in 1986 and are 17 x $10^6 m^3$ in 1987. The established raw reserves of natural gas were 278 x $10^5 m^3$ and are 216 x $10^9 m^3$. 4 figs., 174 tabs.

0302 Geology and Exploration

Refer also to citation(s) 26255

26283 (DOE/MC/21179–T3) **Rock matrix and fracture analysis of flow in western tight gas sands: Phase IV: Quarterly technical progress report, April–June 1988.** Morrow, N.R.; Buckley, J.S.; Cather, M.E.; Brower, K.R. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center. 1988. 18p. DOE Contract AC21-84MC21179. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to develop reliable core analysis techniques for measuring the petrophysical properties of tight gas sands. Recent research has indicated that the flow conditions in the reservoir can be greatly enhanced by the presence of natural fractures, which serve as a transport path for gas from the less permeable matrix. The study is mainly concerned with the dependence of flow in tight gas matrix and healed tectonic fractures on water saturation and confining pressure. This dependency is to be related to the detailed pore structure of tight sands as typified by cores recovered in the Multi-Well experiment. This report describes progress on the following four tasks: (1) advanced core analysis; (2) flow along and across fracture; (3) chemical alteration; and (4) effect of water on gas production. 9 refs., 5 figs.

0303 Drilling, Production, and Processing

Refer also to citation(s) 26507

26284 (DOE/EIA–0130(89/02)) **Natural gas monthly, February 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 25 Apr 1989. 145p. Order Number DE89010970/JAW. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. The data in this publication are collected on surveys conducted by the EIA to fulfill its responsibilities for gathering and reporting energy data. Some of the data are collected under the authority of the Federal Energy Regulatory Commission (FERC), an independent commission within the DOE, which has jurisdiction primarily in the regulation of electric utilities and the interstate natural gas industry. 6 figs., 35 tabs.

26285 (PB–89-161434/XAB) **Higee Technology Development Program. Phase 1. Topical report, January 1988-August 1988.** Smelser, S.C.; Bucklin, R.W.; Ramanathan, R.V.; Lamprecht, D.G.; Fowler, R. Fluor Technology, Inc., Irvine, CA (USA). Jan 1989. 139p. Available from NTIS, PC A07/MF A01.

Phase I results are presented for the Higee Development Program which is organized to bring the high gravity (Higee) centrifugal separator for selective H_2S absorption and stripping to commercial readiness. First-pass designs and cost estimates for a conventional amine treating unit and for conservative and optimistic Higee units were prepared along with designs and cost estimates for sulfur recovery. With only a conservative improvement, Higee could penetrate the high-pressure natural gas treating market based on reduced treating costs; however, this penetration will likely be limited. Results suggest that Higee technology for selective H_2S removal will have broad application if the optimistic improvement in performance is achieved.

0304 Products and By-products

Refer also to citation(s) 26299

0306 Marketing and Economics

Refer also to citation(s) 26268, 26269, 26284, 26292, 26624

26286 (MPUB–1987) **The [Manitoba] Public Utilities Board annual report, 1987.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 1987. 60p. (MICROLOG–89-00798). Available from Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The activities of the Board from 1987 discussed in this report included: natural gas markets and prices, the Greater Winnipeg gas company, propane gas distribution, the telephone system, Manitoba Hydro, water and sewer utilities, highway protection, funeral services, and cemeteries. The revenues of the Board for that year amounted to $852,726, essentially coming from public utilities. 7 figs., 7 tabs.

26287 (NEB-SS-8808) **[Propane and butanes] exports and revenues by company and order.** National Energy Board, Ottawa, Ontario (Canada). 1988. 5p. (CE-02410). Available from Ontario Energy Board, 14 Carlton St., 9th Floor, Toronto, ON, Canada M5B 1J2; $N/C.

Data are presented on Canadian propane and butanes exports and revenues. Monthly information is provided on company name, order number, term of order, current month exports, and total exports. 2 tabs.

26288 (NEB-SS-8809) **Product disposition summary report.** National Energy Board, Ottawa, Ontario (Canada). 1988. 2p. (CE-02412). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C.

Monthly statistics are presented on Canadian propane and butane product disposition. Data are displayed by province and for Canada, and include figures on opening stocks, imports, production, domestic purchase, consumption (industry use, solvent flood, or feedstocks), domestic sales, other sales, exports, losses and adjustments, and closing stocks. 2 tabs.

26289 (OY/PSTL-TIED-54) **Consumption potential and profitability of natural gas in Northern Finland.** Maeenpaeae, I.; Tervo, H. Oulu Univ. (Finland). Research Inst. of Northern Finland. Sep 1988. 43p. (In Finnish). Order Number DE88757320/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The aim of this research was to estimate the consumption potential and profitability on the possible rout for natural gas pipeline planned from Kostamus (USSR) to the coast of the Gulf of Bothnia. The consumption potential was estimated on the basis of inquiries, which covered 43 companies and heating plants. According to the inquiry the total annual consumption potential is approx. 6000 GWh up to the year 2000. Because of long distances and small amounts of consumption towns of Kajaani, Raahe and Rovaniemi were removed from the estimate. The remaining areas were the town of Oulu, the Kemi-Tornio area and one rural community. Hence the consumption potential would be 2900 GWh in the year, 1995 and 5000 GWh in the year 2000. The portion of the consumption in the area of Oulu would be 3000 GWh in the year 2000. The portion of consumption potential of heating plants would be quite large 57%. An alternative fuel for natural gas would be peat in 62% of cases. The costs of natural gas pipelines have been estimated to be 760 million FIM. In the profitability estimation the pipeline was assumed to be ready in the year 1995. The profitability was investigated on the basis of import prices. In the basic inspection the maximum import price was estimated to be FIM/MWh at present fuel price and 5% real profit level. The price exceeds the import price in Southern Finland, 34 FIM/MWh (1987) with 2 FIM. At 10% real profit level the maximum import price would be allowed to be 26 FIM/MWh, which is much lower than the import price at present in the Southern Finland.

26290 (PB-89-154942/XAB) **Gas energy transport and distribution: pipeline or wire.** Lorentzen, G. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). 27 Jun 1988. 17p. (STF-11-A88058). Available from NTIS, PC EE03/MF E03.

Planning of a rational system of energy supply must be based on an end-use analysis to decide in which form and amount the energy should be distributed. In this process, a large number of factors must be taken into consideration; resource availability, prices, overall efficiency, local and global environmental effects, safety, convenience etc. The energy needs in general consumption and most industries are best covered by electricity. A reconstruction of a gas grid for local distribution would be uneconomical and anachronistic. Strong arguments favor location of the gas power plants near the source and energy distribution through the electric trunk line system.

0307 Waste Management

26291 (NEI-DK-142) **Mathematical evaluation of the suitability of larger brick chimneys for natural gas firing and low smoke temperatures.** Energiministeriets forskningsprogram. Fyrings- og forbraendingsteknik. West, M.; Paulsen, O. DK-Teknik, Soeborg (Denmark). [1988]. 92p. (In Danish). Order Number DE88757304/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Energiministeriets forskningsprogram. Fyrings- og forbraendingsteknik.; EFP-86.

In a previcus research project (EFP-83 journal nr. 22642-303), it has been pointed out that brick chimneys should be kept under special observation where firing with natural gas is initiated. Here mathematical models which help to evaluate the effects of smoke from natural gas firing on brick chimneys are presented. The aim is to find a balance between the temperature of the smoke and the chimney's condition so that energy savings can be achieved without detriment to the chimney. (AB).

0309 Artificial Stimulation

26292 (PB-89-161756/XAB) **GRI's (Gas Research Institute's) Natural Gas Supply Subprogram status report, 1988.** Gas Research Inst., Chicago, IL (USA). Dec 1988. 139p. (GRI-88/0358). Available from NTIS, PC A07/MF A01.

See also report for 1987, PB-88-182035.

The major focus of GRI's natural gas supply R&D is on the development of new or improved technology to ensure the cost-effective recovery of gas from known, but marginally economic, gas resources. The Natural Gas Supply Subprogram is organized into six project areas: Tight Gas Sands, Eastern Devonian Gas Shales, Secondary Gas Recovery Technologies, Methane from Coal Deposits, Advanced Technology for Exploration and Production, and Advanced Gas Processing. The status report provides detailed descriptions of each current R&D contract within these project areas, including information on objectives, the role of the contract in the project area strategy, contract results to date, and future plans.

26293 (PB-89-167431/XAB) **Coordination of geological and engineering research in support of the Gulf Coast Co-Production Program. Final report, June 1987-November 1988.** Jirik, L.A.; Ambrose, W.A.; Kerr, D.R.; Light, M.P.R. Texas Univ., Austin, TX (USA). Bureau of Economic Geology. 28 Feb 1989. 134p. Available from NTIS, PC A07/MF A01.

See also PB-88-104625.

Shallow-marine sandstones in Northeast Hitchcock field having high porosities and permeabilities contain abundant authigenic kaolinite and have acted as preferential conduits for fluid migration. Authigenic clay creates fluid production problems because of its delicate structure. Dislodged clay will obstruct pore throats at high production rates. A maximum safe rate of fluid production will need to be determined for co-produced wells. Middle and lower Miocene barrier-island sands in Northeast Hitchcock field have the potential for receiving large volumes of co-produced brines. These sands have permeabilities in excess of 2,000 md, are internally homogeneous, and are laterally extensive in the field area. Detailed geologic analyses of two reservoirs in Seeligson field delineate heterogeneous, fluvial sandstones that probably contain isolated, undrained reservoir compartments. Zone 15 can be subdivided into at least four genetic sandstones, and Zone 18-C can be subdivided into two separate sandstones. Two new pool discoveries (Miocene) in Tom O'Connor field developed during growth-fault activity along the Vicksburg Fault Zone. Deposition of these sandstones, as part of an offshore system during initial parasequence deposition, was confined between the Vicksburg Fault Zone and the Tom O'Connor anticlinal crest.

0310 Legislation and Regulation

Refer also to citation(s) 26277

0320 Transport, Pipelines, and Handling

Refer also to citation(s) 26284, 26875

26294 (PB-89-161418/XAB) **Stratigraphy and depositional systems of the lower cretaceous Travis Peak Formation, East Texas basin. Topical report, July 1987-October 1988.** Tye, R.S.; Diggs, T.N. Texas Univ., Austin, TX (USA). Bureau of Economic Geology. Feb 1989. 90p. Available from NTIS, PC A05/MF A01.

The Travis Peak Formation of the East Texas Basin was divided into five lithostratigraphic units. Formation of a fluvial-deltaic-paralic-shelf depositional systems tract was interpreted from analyses of stratigraphic and sedimentologic data that were acquired for each lithostratigraphic unit from well logs and cores. During early Travis Peak development, braided streams deposited channelbelt, floodplain, and overbank sediments in most of the study area. Downdip of the braided streams, deltas prograded to the south and southeast over a shallow, stable shelf. As braided streams migrated and enlarged, the site of deltaic deposition advanced southward and expanded to the northeast. Estuaries developed in relatively sediment-starved, embayed portions of the shoreline between centers of deltaic deposition. Seaward of the deltas, shelf sandstones accumulated through sediment-gravity processes triggered by high sediment loads and rapid deposition in the deltas. Channelbelts coursed across a coastal plain with expansive floodplains and lakes and fed a few small retrogradational deltas. Estuaries enlarged and became a dominant coastal feature as submergence of the coastal plain progressed. With continued transgression, marine limestone of the Sligo Formation onlapped the Travis Peak.

26295 (SWRI–9010919) **Demonstration of realtime radiography on pipeline girth welds: Final report.** Light, G.M. Southwest Research Inst., San Antonio, TX (USA). Nondestructive Evaluation Science and Technology Div. Sep 1988. 35p. Available from American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 $65.00.

Conventional radiography has been the accepted nondestructive testing (NDT) method used for many years to either "accent" or "reject" a field weld in the pipeline industry. However, conventional radiography requires the expense of film, developing chemicals, and manpower for film development. It also normally has a delay of 2 hours or more between when the weld was radiographed and when the radiographic film of the weld is available for interpretation. Over the last few years, a newer approach to performing radiographic testing, called "realtime" radiography, has been used in several different types of field inspection operations. The realtime radiography system forms the image with optical imaging in lieu of photographic film. Objectives of this project were: (Task 1) Integration of realtime x-ray system components into a realtime-radiographic imaging (RTRI) system for pipeline girth weld inspection. The components to be integrated into the RTRI were identified in the final report for PRC PR-15-625. (Task 2) Shakedown Test demonstration of the integrated RTRI on a section of pipeline in a pipe yard. (Task 3) Field Demonstration of the RTRI on 100 welds in the field. (Task 4) Final Report. Task 1 was completed. Work on Task 2 was performed. Work on Task 3 will not be conducted, since the RTRI did not pass the shakedown test. 7 figs.

0330 Properties

26296 (PB–89-155576/XAB) **Geochemical characterization of gases in the deep hole of the Siljan Ring structure, Sweden. Final report, October 1, 1985-March 31, 1989.** Jeffrey, A.W.A.; Fish, F. Global Geochemistry Corp., Canoga Park, CA (USA). Jan 1989. 165p. Available from NTIS, PC A08/MF A01.

This report provides geochemical analysis of gases, carbonate minerals, extractable bitumen, and performs petrographic studies on fluid and core samples from the Siljan Ring deep-hole drilled by Vattenfall.

26297 (PB–89-158661/XAB) **Analyses of natural gases, 1917-1988. Data file.** Hamak, J.; Miller, R.; Cupell, L. Bureau of Mines, Amarillo, TX (USA). Helium Field Operations. 31 Dec 1988. mag ta Available from NTIS CP T02.

Supersedes PB–88-172325. Source tape is in the ASCII format. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products.

This tape contains routine analyses and related source data for 14858 natural gas samples. These samples were collected as a part of a continuous survey of the free world for occurrences of helium. This survey has been conducted in the United States by the Bureau of Mines since 1917. In late 1965, the study was expanded to include foreign gas fields. Samples released for publication have been published in a series of USBM bulletins and information circulars. The tape contains samples received through December 31, 1988 that were released for publication. (It replaces previous tapes.) There is one record on the tape for each sample analysis. The tape does not contain a label, standard or non-standard. The tape is a nine-track, 1600 BPI, odd-parity, ASCII tape. Each record contains 365 characters. The records are blocked 1 (one) per block. Helium Field Operations of the Bureau of Mines, located in Amarillo, Texas, may be contacted for further information.

0340 Combustion

Refer also to citation(s) 26291, 27123

26298 (PB–89-152284/XAB) **High-performance intercooled and recuperated gas turbine. Topical report, September 1986-October 1988.** Staudt, J.E. Northern Research and Engineering Corp., Woburn, MA (USA). Oct 1988. 206p. (NREC–1626). Available from NTIS, PC A10/MF A01.

A preliminary design for a Dresser-Rand DC990 industrial gas turbine engine modified for intercooling and recuperation (ICR) is presented. The DC990 was selected because its configuration is amenable to intercooling and because it is in the power range of interest. Based upon preliminary estimates, engine power output will increase from 6000 to 8400 bhp at design point. Design-point specific fuel consumption will be reduced 26% to a heat rate of 6300 BTU/bhp-hr. Moreover, the DC990 ICR engine maintains a high thermal efficiency during part-load operation. These performance improvements are achievable using proven, low-risk technology. The resulting combination of low fuel consumption and low maintenance costs makes the DC990 ICR gas turbine engine an attractive engine package for several applications.

26299 (PB–89-161467/XAB) **New directions for the catalytic conversion of methane. Annual report, January-December 1988.** Lunsford, J.H. Texas A and M Univ., College Station, TX (USA). Dept. of Chemistry. Jan 1989. 29p. Available from NTIS, PC A03/MF A01.

Melts prepared from lithium carbonate and slurries of molten lithium carbonate with magnesium oxide or lanthanum oxide are effective catalysts for the oxidative dimerization of methane to ethane, with the subsequent conversion of ethane to ethylene (C2 compounds). The reaction was studied in an alumnina crucible which was filled with alumina rings to disperse the reactant gases in the molten phase. With 30 g of Li2CO3 in the reactor at 800 C and a CH4:O2 ratio of approximately 2, a conversion of 40% and a selectivity of 49% were observed at steady state. The addition of up to 20% of wt. of MgO caused an increase both in the CH4 conversion and the C2 selectivity; whereas, the addition of La2O3 caused a small decrease in conversion but an increase in selectivity. The positive effect observed with MgO is believed to result from the combined activity of the melt and the surface of MgO. Initially the nominally pure, molten Li2CO3 is essentially inactive for the production of C2's, but as part of the carbonate decomposes an active oxide phase is formed. This process is reversible in that the addition of CO2 to the system converts the melt back to its inactive state. Under normal operating conditions, the reaction of CH4 with CO2 to form H2 and CO accounts for the consumption of up to 25% of the CH4. Lithium carbonate and sodium carbonate form an eutectic, but the catalytic properties of this melt are inferior to those obtained with pure lithium carbonate.

04 OIL SHALES AND TAR SANDS

Refer also to citation(s) 27784

26300 (AOSTRA–26) **The Alberta oil sands.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1977. 17p. (CE–02468). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The oil sands deposits of Alberta are found in 4 principal and several minor deposits in northern and eastern Alberta, in Athabasca, Cold Lake, Peace River, and Wabasca. This document

provides a brief description of the commercial development by the Great Canadian Oil Sands Ltd. and Syncrude Canada Ltd., including a history of each company, a description of the project, ownership, and labour agreements; experimental work conducted; a description of the main town identified with the oil sands projects, called Fort McMurray; the significance of synthetic crude oil; and the role of the various Alberta government departments and agencies in the development and ongoing operation. Maps of the area and of Fort McMurray are included. 7 figs.

26301 (AOSTRA–1986) **Alberta oil sands index. Selected bibliography.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). [1989]. 26p. (CE–02462). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This is a selected bibliography of items held by the library, listed by accession number and arranged by category: analysis and properties; commercial development; economics; environment; geosciences; government; history; in situ recovery; mining; products; related subjects; separtion; social impact; and upgrading.

0402 Site Geology and Hydrology

Refer also to citation(s) 26254

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 26202, 26306

26302 (CONF-880589–) **International conference on oil shale and shale oil: Proceedings.** Zhu Ya-Jie (ed.). Colorado School of Mines, Golden, CO (USA). 1988. 689p. DOE Contract FG21-88MC11092. From International conference on oil shale and shale oil; Beijing, CN; May 16, 1988. Order Number DE89010445/JAW. Available from NTIS, PC A99 - OSTI - Chemical Industry Press, Huaxue Gongye Chubanshe, 16 Lou, 7 Qu, Hepingli, Beijing, China.

Research programs which were discussed at the international conference on oil shale and shale oil in Beijing, China, are presented. Major topics include: geology, geochemistry, processing, extraction and liquefaction, pyrolysis, retorting, upgrading of shale oil, combustion, shale ash utilization, environmental impact, and industrial development assessment. Individual projects are processed separately for the data bases. (CBS)

0405 Properties and Composition

Refer also to citation(s) 26302

26303 (AOSTRA–8104) **Alberta oil sands sample bank.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 1981. 12p. (CE–02485). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The rapid increase in research and development effort in all phases of oil sand technology has emphasized the need for well documented, properly taken and stored samples of oil sand, bitumen and related materials. The oil sands sample bank stocks representative samples from all deposits in Alberta, of oil sand and/or bitumen and samples of other related materials; ensures that the samples are properly taken and stored so as to maintain, as much as possible, their original composition; monitors the changes in stored samples, and discards those no longer representative of the original material; provides a complete description of the sample and its history since it was taken; studies the changes that occur so as to develop optimum storage conditions; develops standard procedures for bitumen reference samples, bitumen and heavy oil in situ production samples, hot water process samples, and oil sand samples.

0408 Marketing and Economics

26304 (ACR/OSTF–8803) **Outlook on oil sands #2. Canada's unique opportunity.** Alberta Chamber of Resources, Edmonton, AB (Canada). Oil Sands Task Force. 1988. 20p. (MICROLOG–88-05968). Available from Alberta Chamber of Resources, 10235 - 101 St., Ste. 1410, Edmonton, AB, Canada T5J 3G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper points out the unique characteristics of oil sands resources and the socio-economic benefits associated with oil sands development projects. It reviews options for meeting Canada's oil supply needs, identifies benefits associated with domestic production, identifies conditions that affect development of Canada's unconventional oil resources, shows the true potential of the Athabasca oil sands, and suggests an action plan that would be in Canada's best interest. 12 refs., 6 figs., 8 tabs.

0409 Waste Research and Management

Refer also to citation(s) 26302

26305 (INTERAT–1987) **Feasibility study for a field sampling program to monitor impacts resulting from in-situ heavy oil subsurface disposal practices.** INTERA Technologies Ltd., Ottawa, ON (Canada). 1987. 60p. (MICROLOG–89-01362). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report evaluates the feasibility of a field sampling program to monitor impacts resulting from waste fluid injection in deep sedimentary formations in the oil sands and heavy oil areas of Alberta. This evaluation was completed through assessment of the liquid waste disposal situation in the Cold Lake area, Alberta and the design of a field sampling program. The assessment of the liquid waste disposal problem was based on review of existing hydrogeological data and theoretical calculations for each injection horizon using available data. From both of these studies, it is concluded that reliable assessment of the impact of waste fluid injection requires more definitive field data. The field sampling program was designed using: a hydrostratigraphic unit evaluation in conjunction with constraint mapping for siting wells to assess background conditions and to monitor the impact of waste injection; and a detailed review of field testing methodologies. Three potential waste fluid injection horizons were evaluated for the study area using constraint mapping. Depending on the location of waste disposal, any one of the three zones may be suitable for such operations. However, the preferred horizons do not always agree with those currently in use. Three different field sampling programs were developed as part of this study. These include a monitoring program in existing wells, a limited testing program in existing wells, and a full scale testing program. 132 refs., 33 figs., 35 tabs.

0410 Environmental Aspects

Refer also to citation(s) 26302, 27316

26306 (PB–89-147292/XAB) **UNOCAL 76: Parachute Creek Shale Oil Program. Environmental Monitoring Plan annual report, January 1-September 30, 1987.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 Mar 1988. 80p. (REPT–88-1A). Available from NTIS, PC A05/MF A01.

See also PB–89-147300.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The Program agreed to comply with existing environmental-monitoring regulations and to develop an Environmental Monitoring Plan incorporating supplemental monitoring in the areas of water, air, solid waste, and worker health and safety during the period 1985-1992. The Program site includes three entities: the Mine/Retort, atop Long Ridge; the Upgrade Facility down valley; and the Retorted Shale Disposal area at the base of Long Ridge. Results of the first year of EMP monitoring are summarized in the document with emphasis on worker health surveillance.

05 NUCLEAR FUELS

0501 Reserves, Exploration, and Mining

26307 (INIS-BR–1458, pp. 188) **Indoor radon in some Portuguese dwellings.** Faisca, M.C. (LNETI, Sacavem (Portugal). Dept. de Protecao e Seguranca Radiologica); Teixeira, M.M.G.R.; Bittencourt, A.O. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADON/contamination; RADON/photographic film detectors; RADON/uranium mines; RADON; CONTAMINATION

26308 (INIS-mf–11405) **Uranium in South Africa: 1987.** Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Jun 1988. 30p. English Order Number DE88706287/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

South Africa's participation in the nuclear industry was limited to the production of uranium and research, with minor commercial activities. The commissioning of the Koeberg Nuclear power station in 1984 placed South Africa firmly on the path of commercial nuclear power generation. A unique locally developed uranium enrichment process wil enable South Africa to be self-sufficient in its nuclear-fuel needs. Uranium has always been of secondary importance to gold as a target commodity in the exploration of the quartz-pebble conglomerates. In the Witwatersrand Basin it is estimated that in excess of R300 million was spend on exploration during 1987. This was spend primarily in the search for gold but as many of the gold reefs are uraniferous, new uranium resources are being discovered concurrently with those of gold. Uranium mineralization is present in rocks which encompass almost the whole of the geological history of South Africa. Significant mineralization is restricted to five fairly well-defined time periods. Each period is characterized by a distinct type or combination of types of mineralization. Resource estimates are divided into separate categories that reflect different levels of confidence in the quantities reported. The resource categories are further separated into levels of exploitability based on the estimated cost of their exploitation. A major part (87%) of South Africa's uranium resources is present as a by-product of gold in the quartz-pebble conglomerates of the Witwatersrand Basin. The uranium resources in the RAR and EAR-I categories were 536 500 t u. Production during 1987 was 3963 t u. Although a production peaking at over 1100 t U/a is theoretically attainable, it is considered, from market projections, that a production ceiling of 10 000 t U/a would be more realistic.

0504 Feed Processing

26309 (CONF-890470–) **Proceedings of the eighth symposium on training of nuclear facility personnel.** Oak Ridge National Lab., TN (USA). Apr 1989. 629p. DOE Contract AC05-84OR21400. From 8. symposium on training of nuclear facility personnel; Gatlinburg, TN, US; April 23, 1989. Order Number DE89010164/JAW. Available from NTIS, PC A99/MF A01 - OSTI; GPO Dep.

This conference brought together those persons in the nuclear industry who have a vital interest in the training and licensing of nuclear reactor and nuclear fuel processing plant operators, senior operators, and support personnel for the purpose of an exchange of ideas and information related to the various aspects of training, retraining, examination, and licensing. The document contains 64 papers; each paper was abstracted for the data.

26310 (FRCEA-TH–192) **Production of ferric sulphate from pyrite by thiobacillus ferrooxidans. Application to uranium ore leaching.** Rouas, C. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France); Aix-Marseille-1 Univ., 13 - Marseille (France). Dec 1988. 164p. (In French). Order Number DE89764015/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

A process for uranium extraction by oxidizing solutions of ferric sulphate produced by T. ferrooxidans from pyrite is developed. A new counting method specific of T. ferrooxidans is designed. An uranium resistant wild strain, with oxidizing properties as high as the strain ATCC 19859, is isolated. Optimal conditions for ferric sulphate production from pyrite are defined (pH 1.8, density of the medium 1.2%, pyrite granulometry < 60 micrometers). The comparison of oxidation of 2 pyrites evidences the effect of composition and crystal type on bacterial activity. Latency period is reduced by preliminary adaptation of bacteria to pyrite, a relatively important inoculum and association of T. ferrooxidans to T. thiooxidans. Free bacteria, but not adsorbed bacteria, play an important part in pyrite oxidation, indirectly by regeneration of ferric iron and by maintaining a high redox potential. Leaching of an uranium ore column by an acidic solution of ferric iron increase not only uranium extraction yield but also to decrease acid consumption in respect to acid leaching only.

26311 (INIS-BR–1458, pp. 166) **Particle size distribution in monazite dust.** Cunha, K.M. da (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)); Carvalho, S.M.M.; Leite, C.V.B.; Baptista, G.B.; Paschoa, A.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

THORIUM/aerosols; THORIUM/particle size; URANIUM/aerosols; URANIUM/particle size; ISOTOPE RATIO; ISOTOPE SEPARATION PLANTS; MEV RANGE 01-10; MONAZITES; PIXE ANALYSIS; PROTON BEAMS; THORIUM; AEROSOLS; URANIUM

26312 (INIS-BR–1458, pp. 168) **Trace uranium concentration in domestic water by SSNTD technique.** Bansal, V. (Aligarh Muslim Univ. (India)); Tyagi, R.K.; Rajendra Prasad. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

URANIUM/dielectric track detectors; URANIUM/quantity ratio; URANIUM/water; ETCHING; FISSION TRACKS; IRRADIATION; THERMAL NEUTRONS; URANIUM; WATER

26313 (LA–11480) **A visible/near-ir spectral database for plutonium solutions of known nitric acid, fluoride, and oxalate composition.** Day, R.S.; Vigil, A.R.; Marsh, S.F. Los Alamos National Lab., NM (USA). Apr 1989. 24p. DOE Contract W-7405-ENG-36. Order Number DE89010761/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fluoride and oxalate are common components of plutonium process solutions. Unfortunately, these anions form highly stable complexes that interfere in many plutonium process operations. Knowledge of the fluoride and oxalate content of process solutions may allow appropriate corrective action to be taken to prevent such interference. On-line spectrophotometry, which is being developed to monitor process solutions at the Los Alamos Plutonium Facility, has the potential to detect and estimate the concentration of these two anions and other solution constituents when the spectral data are processed using chemometric techniques. Spectra of 126 solutions that contained known concentrations of plutonium, fluoride, oxalate, and nitric acid were acquired as a database for on-line spectrophotometry. These spectra and a discussion of their unique spectral features are presented. 4 refs., 34 figs.

26314 (LA–11490) **Evaluation of a new, macroporous polyvinylpyridine resin for processing plutonium using nitrate anion exchange.** Marsh, S.F. Los Alamos National Lab., NM (USA). Apr 1989. 15p. DOE Contract W-7405-ENG-36. Order Number DE89010760/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Anion exchange in nitric acid is the major aqueous process used to recover and purify plutonium from impure scrap materials. Most strong-base anion exchange resins incorporate a styrene-divinylbenzene copolymer. A newly available, macroporous anion exchange resin based on a copolymer of 1-methyl-4-vinylpyridine and divinylbenzene has been evaluated. Comparative data for Pu(IV) sorption kinetics and capacity are presented for this new resin and two other commonly used anion exchange resins. The

new resin offers high capacity and rapid sorption kinetics for Pu(IV) from nitric acid, as well as greatly stability to chemical and radiolytic degradation. 8 refs., 14 figs.

0505 Uranium Enrichment

26315 (K/ITP–171) **Modeling vapor-liquid equilibrium of UF_6 and common impurities.** Davis, W. Jr.; Cochran, H.D. Oak Ridge Gaseous Diffusion Plant, TN (USA). Mar 1989. 43p. DOE Contract AC05-84OT21400. Order Number DE89010410/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the safe handling and processing of uranium hexafluoride (UF_6), it is often desirable to calculate vapor composition and pressure from known liquid composition and temperature. Furthermore, it would be economically advantageous to the International Atomic Energy Agency (IAEA), in its international safeguards program, and to uranium enrichment operators to be able to use analyses of equilibrium vapor-phase samples to calculate liquid-phase compositions. Either type of calculation could be performed with a multicomponent vapor-liquid equilibrium (VLE) model if this model were shown to apply to UF_6 and its common impurities. In the present and earlier studies, the model and computer programs developed by J.M. Prausnitz and his coworkers has been adapted and tested for their ability to correlate experimental data on vapor-liquid equilibria between UF_6 and some of its many potential impurities. Because of its polymerization, hydrogen fluoride must be treated as a special component. However, VLE of the balance of components, including N_2, O_2, F_2, SiF_4, and ClF_3, are accurately described by treating vapor-phase nonidealities by the Haydon-O'Connell equation and liquid-phase nonidealities by the UNIQUAC equation in the model of Prausnitz et al. This report describes the results of analyzing VLE involving UF_6 as a solute for some known impurities. It also describes the formation of F_2 and lower uranium fluorides from the self α-radiolytic decomposition of UF_6. 68 refs., 7 figs., 7 tabs.

0507 Fuels Production and Properties

26316 (DP-MS–89-38) **Modeling of combustion processes in a solid fuel particle.** Howard, D.W. Savannah River Lab., Aiken, SC (USA). 1989. 20p. DOE Contract AC09-76SR00001. (CONF-8905103–1: 2. annual ABAQUS users' conference, Stresa, IT, May 24, 1989). Order Number DE89008306/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the production of granules or uranium oxide, granules of ion-exchange resin, loaded with uranium ions, are burned to remove the resin matrix and leave a uranium oxide "ash". Under some conditions of combustion, the oxide granules are produced in a highly fractured, porous state, while other conditions result in hard, dense, solid granules. ABAQUS was used to model the physical processes occurring during combustion: heat transfer with a very non-linear temperature dependent rate of heat generation, diffusion of reactants and products, and stress/strain resulting from the differential temperatures and from the phase changes during the combustion. The ABAQUS simulation was very successful in explaining the differences in morphology of the granules under different conditions, and in leading to control strategies to produce the desired morphology. However, some of the limitations of ABAQUS prevented obtaining as accurate a simulation as desired. 10 figs.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 26313, 26314, 26564, 26859

26317 (KFK–4518) **DIDI - programme for computing the measurement model of a reprocessing facility.** Bicking, U.; Seifert, R. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung. Mar 1989. 27p. (In German). (PWA–1/89). Order Number DE89764716/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The programme DIDI (Programme for Computing the Measurement Model of a Reprocessing Facility - Discontinuous Dispersion Matrix) is able to compute the measurement model that means the variance/covariance matrix of a one-block model of a reprocessing plant. Therefore DIDI is the connecting piece between the data resulting from the working of the reprocessing facility and PROSA (Programme for Statistical Analysis of NRTA Data). Input are either inventory data or process-inventory data, all transfers and the relative standard deviations, respectively, random, as well as systematical. Output is primarily the variance/covariance matrix (measurement model) of the reprocessing plant. But also the absolute standard deviations, random as well as systematical, the MUF and CUMUF series, the variance of CUMUF and the Neyman-Pearson optimum loss-pattern will be computed. If the process-inventory data are part of the input also the inventory will be computed. The programme DIDI is written in FORTRAN 77. This version 2.0 is tested on a host computer (IBM 3090) and on a personal computer with operating system DOS.

26318 (ORNL/TM–10847) **Advanced servomanipulator remote maintenance demonstration.** Ray, T.L.; Bradley, E.C. Oak Ridge National Lab., TN (USA). Mar 1989. 50p. DOE Contract AC05-84OR21400. Order Number DE89010188/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The advanced servomanipulator (ASM) is a dual-arm, force-reflecting, master/slave servomanipulator that was designed for remote maintenance applications and is digitally controlled. The ASM is installed in the Maintenance Systems Test Area (MSTA) of the Fuel Recycle Division at the Oak Ridge National Laboratory. The unique aspect of ASM is that the slave arms were designed to be remotely maintainable, using a similar remote manipulator system, to maximize availability and minimize downtime. This test report describes the results of the maintenance testing conducted on ASM. Demonstration of the ability to maintain ASM remotely is an important precursor to the ultimate application of ASM in a totally remote facility. The approach taken in the design of ASM was for the manipulator slave arms to be composed of modules capable of being removed and replaced by another manipulator system of similar capabilities. The ASM incorporates gear and torque tube drives with drive couplings that facilitate remote maintenance. Although the use of special fixtures is normally discouraged for remote maintenance, special fixtures were required for this demonstration due to the complex nature of the slave arms. This test was performed to demonstrate that the ASM slave arms could be completely disassembled and reassembled remotely. Maintenance of ASM was successfully demonstrated using the M-2 servomanipulator and special fixtures. The entire disassembly process took about 4 h, and the assembly took about 3 1/2 h. Although there were some problems, in general, the arm modules were adequately designed for remote removal and replacement. Recommendations, which are documented in this report, have been made for improvements. 5 refs., 22 figs., 1 tab.

26319 **Electrorefining process and apparatus for recovery of uranium and a mixture of uranium and plutonium from spent fuels.** Ackerman, J.P.; Miller, W.E. To Dept. of Energy. USA Patent Application 7-117,880. 5 Nov 1987. 23p. DOE Contract W-31109-ENG-38. Order Number DE89010948/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An electrorefining process and apparatus for the recovery of uranium and a mixture of uranium and plutonium from spent fuels is disclosed using an electrolytic cell having a lower molten cadmium pool containing spent nuclear fuel, an intermediate electrolyte pool, an anode basket containing spent fuels, two cathodes and electrical power means connected to the anode basket, cathodes and lower molten cadmium pool for providing electrical power to the cell. Using this cell, additional amounts of uranium and plutonium from the anode basket are dissolved in the lower molten cadmium pool, and then purified uranium is electrolytically transported and deposited on a first molten cadmium cathode. Subsequently, a mixture of uranium and plutonium is electrotransported and deposited on a second cathode. 3 figs.

0509 Transport and Storage

Refer also to citation(s) 26680

26320 Porcelain enamel neutron absorbing material. Iverson, D.C. To Dept. of Energy. USA Patent Application 7-123,462. 20 Nov 1987. 16p. DOE Contract AC09-76SR00001. Order Number DE89010952/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A porcelain enamel composition as a neutron absorbing material can be prepared of a major proportion by weight of a cadmium compound and a minor proportion of compound of boron, lithium and silicon. These compounds in the form of a porcelain enamel coating or layer on several alloys has been found to be particularly effective in enhancing the nuclear safety of equipment for use in the processing and storage of fissile material. The composition of the porcelain enamel coating can be tailored to match the coefficient of thermal expansion of the equipment to be coated and excellent coating adhesion can be achieved. 2 figs.

0510 Marketing, Economics, and By-products

Refer also to citation(s) 26308

0520 Waste Management

Refer also to citation(s) 26386, 26387, 26388, 26492, 27127, 27176, 27764

26321 (AEEW-M–2513) **Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Third semestrial report July-December 1987.** Howard, C.G.; Jolliffe, C.; Lee, D.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Apr 1988. 23p. English (CPDG–88-P-016). Order Number DE88706277/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The aim of the programme is to show that ion exchange resins used to remove activity from decontaminating agents used in water reactors can be successfully immobilised in cement. To achieve this, blends of Ordinary Portland Cement and ground granulated Blast Furnace Slag (ratio 9:1) have been used. Improvements in the properties of the product and the waste loading of 50 w/o damp resin can be achieved using microsilica, a finely divided form of silicon dioxide, as an additive to the blended cement. This report contains data on the effects of anion resins, and mixed anion/cation resins, on the performance of the cemented product. The effects of organic acids, especially picolinic and formic acids, bound to anion resins have also been investigated. In addition, formulations developed have been assessed at commercial scale (200 litres of cemented product) for their process and product characteristics. The final part of the report deals with the long-term product performance of samples prepared from cation resins which are now nearly one year old.

26322 (BNL–42563) **Leaching induced concentration profiles in the solid phase of cement.** Fuhrmann, M.; Colombo, P. Brookhaven National Lab., Upton, NY (USA). Apr 1987. 29p. DOE Contract AC02-76CH00016. (CONF-870511–6: 4. international hazardous waste symposium on environmental aspects of stabilization-solidification of hazardous and radioactive wastes, Atlanta, GA, US, May 3, 1987). Order Number DE89010503/JAW. Available from NTIS, PC A03 - OSTI.

Analysis of the solid phase of portland cement specimens by energy dispersive x-ray spectrometry before and after leaching provided elemental profiles within the cement. Releases of potassium were calculated from the solid phase profiles and were compared to releases determined from leachate analyses of potassium and cesium-137. The fraction of potassium released in the leachate was found to correlate closely to that of cesium-137 under varying time and temperature conditions, despite the different manner in which each was originally contained in the cement. Agreement was obtained among potassium releases as determined from the solid, potassium in the leachate and cesium-137 in the leachate. These correlations allowed the use of potassium as an analog for cesium-137 in cement. Profiles of potassium in the solid showed varying degrees of depletion. A specimen, sectioned immediately after leaching for 471 days, showed complete removal of potassium to 9 mm depth from the specimens surface. From 9 mm to the center of the specimen, an apparently linear increase in concentration was observed. Specimens that had been air dried prior to sectioning had profiles that were produced by evaporative transport of dissolved species toward the surface. Carbonation of the surface appears to have retarded migration of the dissolved material. This prevented it from reaching the outer edge and resulted in increased potassium concentrations several mm inside the surface. 9 refs., 10 figs., 2 tabs.

26323 (CONF-890401–7) **Repository-relevant testing applied to the Yucca Mountain Project.** Bates, J.K.; Gerding, T.J.; Veleckis, E. Argonne National Lab., IL (USA). Apr 1989. 26p. DOE Contract W-31109-ENG-38. From 197. national meeting of the American Chemical Society; Dallas, TX, US; April 9, 1989. Order Number DE89010701/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A repository environment poses a challenge to developing a testing program because of the diverse nature of conditions that may exist at a given time during the life of the repository. A starting point is to identify whether any potential waste-water contact modes are particularly deleterious to the waste form performance, and whether any interactions between materials present in the waste package environment need to be accounted for during modeling the waste form reaction. The Unsaturated Test method in one approach that has been developed by the Yucca Mountain Project (YMP) to investigate the above issues, and a description of results that have been obtained during the testing of glass and unirradiated UO_2 are the subject of this report. 10 refs., 7 figs., 4 tabs.

26324 (DOE/ID–10112-Rev.3) **INEL low-level radioactive waste acceptance criteria: Revision 3.** Wilkinson, D.R. USDOE Idaho Operations Office, Idaho Falls, ID (USA). Mar 1987. 104p. DOE Contract AC07-76ID01570. (MISC–89014). Order Number DE89011149/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This document delineates the criteria for: shipping low-level waste (LLW) to the Radioactive Waste Management Complex (RWMC), and shipping LLW to the Waste Experimental Reduction Facility (WERF) for metal recycling or volume reduction. General information concerning disposal of contaminated waste materials is contained in Section 1. Two categories of waste are defined in Section 2. General criteria pertaining to all waste is summarized in Section 3. Processable waste classifications are identified in Section 4. Nonprocessable, direct disposal, waste classifications are identified in Section 5. Section 6 presents a list of the required documentation that must accompany each shipment of waste. Standard containers acceptable for shipping waste to the RWMC and WERF are described in Section 7.

26325 (DOE/ID–22078) **Hydrologic conditions at the Idaho National Engineering Laboratory, 1982 to 1985.** Pittman, J.R.; Jensen, R.G.; Fischer, P.R. EG and G Idaho, Inc., Idaho Falls, ID (USA); Geological Survey, Idaho Falls, ID (USA). Dec 1988. 79p. DOE Contract AC07-76ID01570. (MISC–89025; USGS/WRIR–89-4008). Order Number DE89010979/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Aqueous chemical and radioactive wastes discharged since 1952 to unlined ponds and wells at the INEL (Idaho National Engineering Laboratory) have affected water quality in perched ground-water zones and in the Snake River Plain aquifer. Routine wastewater disposal was changed from a deep injection well to ponds at the ICPP (Idaho Chemical Processing Plant) in 1984. During 1982-85, tritium concentrations increased in perched ground-water zones under disposal ponds, but cobalt-60 concentrations decreased. In 1985, perched ground water under TRA (Test Reactor Area) disposal ponds contained up to 1770 $\pm$ 30 pCi/mL (picocuries per millimeter) of tritium and 0.36 $\pm$ 0.05 pCi/mL of cobalt-60. 35 refs., 35 figs., 6 tabs.

26326 (DOE/LLW–70T) **Guidance for preparation of site-specific storage acceptance criteria for greater-than-Class C low-level radioactive waste.** Fischer, D.K.; Knecht, M.A. EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1989. 19p. DOE Contract AC07-76ID01570. (MISC–89034). Order Number DE89011141/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document identifies the concerns and generic requirements that must be addressed when preparing criteria for acceptance of greater-than-Class C (GTCC) low-level waste (LLW) for storage at a DOE waste management facility. It provides a baseline from which waste acceptance criteria, specific to a given storage facility, can be developed. Neither the NRC nor DOE has prescriptive regulations that specifically address management of GTCC LLW. Therefore, the guidance given herein is derived from several sources. 2 tabs.

26327 (DOE/LLW–80) **RIMS [Records Inventory Management System] Handbook.** EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1989. 241p. DOE Contract AC07-76ID01570. (MISC–89033). Order Number DE89011054/JAW. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The Records Inventory Management System (RIMS) is a computer library of abstracted documents relating to low-level radioactive waste. The documents are of interest to state governments, regional compacts, and the Department of Energy, especially as they relate to the Low-Level Radioactive Waste Policy Act requiring states or compacts of states to establish and operate waste disposal facilities. RIMS documents are primarily regulatory, policy, or technical documents, published by the various states and compacts of the United States; however, RIMS contains key international publications as well. The system has two sections: a document retrieval section and a document update section. The RIMS mainframe can be accessed through a PC or modem. Also, each state and compact may request a PC version of RIMS, which allows a user to enter documents off line and then upload the documents to the mainframe data base.

26328 (DOE/OR/00033–T419) **Gas phase migration of C-14 through barrier materials applicable for use in a high-level nuclear waste repository located in tuff.** Bauer, L.R. Purdue Univ., Lafayette, IN (USA). Dec 1988. 127p. DOE Contract AC05-76OR00033. Order Number DE89010158/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

A study of the movement of $^{14}CO_2$ through proposed barrier media has been conducted. Diffusion coefficients for crushed tuff, bentonite and a 90:10% by wt. mixture of crushed tuff and bentonite were measured for two diffusion lengths. The ability of $^{14}CO_2$ to penetrate a microsilica-containing portland cement mortar proposed for repository use was also examined. The specimens were subjected to uniaxially-applied compressive loads prior to the diffusion tests to simulate the onset of environmentally-induced microcracks. 91 refs., 14 figs., 15 tabs.

26329 (DOE/OR/00033–T424) **Determination of radionuclide concentrations of U and Th in unprocessed soil samples.** Lazo, E.N. Florida Univ., Gainesville, FL (USA). 1988. 350p. DOE Contract AC05-76OR00033. Order Number DE89010612/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This technique improves on gamma spectroscopic analysis because progeny equilibrium is not required, improves on neutron activation analysis because bulk samples are assayed, and improves on both methods because standard soil samples are not needed for system calibration. The assay system developed equates a measured $K_{\alpha 1}$ x-ray peak area to a calculated "Geometry Factor" (GF) times the unknown soil sample radionuclide concentration. From this equation the radionuclide concentration is determined. Spectral data are generated by irradiating the soil sample with Co-57 gammas to induce fluorescent x-rays which are measured using an intrinsic Ge detector. The Co-57 sources, the sample, and the detector are oriented to optimize the production of fluorescent x-rays. Transmission gamma rays are then used to determine the sample linear attenuation coefficient at the $K_{\alpha 1}$ energy of interest. Peak areas are determined by shaping spectral data to a Voigt Profile using an algorithm from the peak shaping program GRPANL. The steeply sloping nature of the Compton backscatter hump on which the $K_{\alpha 1}$ x-ray peaks rest necessitated the development of a unique polynomial/erfc background function which is subtracted prior to peak shaping. The GF of a sample is the calculated number of $K_{\alpha 1}$ x-rays which would be counted in the full energy spectral peak if the contamination concentration in the sample were one picoCurie per gram. This calculated GF includes considerations of the sample linear attenuation coefficient, fluorescence induced by unscattered source gammas, fluorescence induced by singly scattered Compton gammas which account for approximately 15% of all production, and natural fluorescence production. 28 refs., 14 figs., 54 tabs.

26330 (DOE/RL–87-04) **Proposed method for assigning metric tons of heavy metal values to defense high-level waste forms to be disposed of in a geologic repository.** Department of Energy, Richland, WA (USA). Richland Operations Office. Aug 1987. 33p. DOE Contract AC06-87RL10930. Order Number DE89011039/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A proposed method is described for assigning an equivalent metric ton heavy metal (eMTHM) value to defense high-level waste forms to be disposed of in a geologic repository. This method for establishing a curie equivalency between defense high-level waste and irradiated commercial fuel is based on the ratio of defense fuel exposure to the typical commercial fuel exposure, MWd/MTHM. application of this technique to defense high-level wastes is described. Additionally, this proposed technique is compared to several alternate calculations for eMTHM. 15 refs., 2 figs., 10 tabs.

26331 (DOE/RL–88-33) **Hanford Site Waste Management Plan.** Westinghouse Hanford Co., Richland, WA (USA). Dec 1988. 147p. DOE Contract AC06-87RL10930. Order Number DE89011034/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Hanford Site Waste Management Plan (HWMP) was prepared in accordance with the outline and format described in the US Department of Energy Orders. The HWMP presents the actions, schedules, and projected costs associated with the management and disposal of Hanford defense wastes, both radioactive and hazardous. The HWMP addresses the Waste Management Program. It does not include the Environmental Restoration Program, itself divided into the Environmental Restoration Remedial Action Program and the Decontamination and Decommissioning Program. The executive summary provides the basis for the plans, schedules, and costs within the scope of the Waste Management Program at Hanford. It summarizes fiscal year (FY) 1988 including the principal issues and the degree to which planned activities were accomplished. It further provides a forecast of FY 1989 including significant milestones. Section 1 provides general information for the Hanford Site including the organization and administration associated with the Waste Management Program and a description of the Site focusing on waste management operations. Section 2 and Section 3 describe radioactive and mixed waste management operations and hazardous waste management, respectively. Each section includes descriptions of the waste management systems and facilities, the characteristics of the wastes managed, and a discussion of the future direction of operations.

26332 (DOE/RW–0216) **OCRWM supercomputer requirements analysis.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). Dec 1988. 101p. Available from OSTI, PO Box 62, Oak Ridge, TN 3783106 - OSTI.

The OCRWM program involves to a large extent the use of computer codes to conduct performance and safety analyses. A variety of computer codes are developed and used by OCRWM contractors. Some OCRWM contractors utilize supercomputer capacity already available at the laboratories (e.g., CRAY-XMP/48 or CRAY-XMP/24) and others utilize smaller computers (e.g., front-end machines, workstations, or PCs). The purpose of this requirements analysis is to identify the computational capacity needs of OCRWM and its contractors from 1989 to 1998 (assuming that all appropriate OCRWM codes are translated into supercomputer usage). Included in this report are: the geographic and organizational locations of OCRWM's computational capacity needs, as estimated from existing and projected in-house and contractor requirements; the generic and specific computer codes expected to be used by OCRWM; the expected machine requirements for the codes to be used, considering such parameters as computational needs and input/output complexity; and the expected supercomputer computational demand over the ten-year period of interest. 2 figs., 4 tabs.

26333 (DOE/SR-WM–89-1) **Savannah River Waste Management Operations Program Plan, FY 1989.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. Dec

1988. 205p. DOE Contract AC09-76SR00001. Order Number DE89010402/JAW. Available from NTIS, PC A10 - OSTI.

This document provides the Waste Management Program Plan as requested. The primary purpose of the plan is to provide an annual report of how waste management's operations are conducted, what facilities are being used to manage wastes, what forces are acting to change current waste management systems, and what plans are in store for the coming fiscal year. In addition, this document projects activities for several years beyond the coming fiscal year in order to adequately plan for safe handling, storage, and disposal of radioactive wastes generated at Savannah River and for developing technology for improved management of wastes. A revised plan will be issued at the beginning of each fiscal year. In this document, work descriptions and milestone schedules are current as of September 1988. Budgets are based on available information as of September 1988.

26334 (DOE/WIPP–89-011) **Draft plan for the Waste Isolation Pilot Plant test phase: Performance assessment and operations demonstration.** USDOE Albuquerque Operations Office, Carlsbad, NM (USA). Waste Isolation Pilot Plant Project Office. Apr 1989. 332p. Order Number DE89010654/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

The mission of the Waste Isolation Pilot Plant (WIPP) Project is to provide a research and development facility to demonstrate the safe disposal of transuranic (TRU) radioactive wastes resulting from United States defense programs. With the Construction Phase of the WIPP facility nearing completion, WIPP is ready to initiate the next phase in its development, the Test Phase. The purpose of the Test Phase is to collect the necessary scientific and operational data to support a determination whether to proceed to the Disposal Phase and thereby designate WIPP a demonstration facility for the disposal of TRU wastes. This decision to proceed to the Disposal Phase is scheduled for consideration by September 1994. Development of the WIPP facility is the responsibility of the United States Department of Energy (DOE), whose Albuquerque Operations Office has designated the WIPP Project Office as Project Manager. This document describes the two major programs to be conducted during the Test Phase of WIPP: (1) Performance Assessment for determination of compliance with the Environmental Protection Agency Standard and (2) Operations Demonstration for evaluation of the safety and effectiveness of the DOE TRU waste management system's ability to emplace design throughput quantities of TRU waste in the WIPP facility. 42 refs., 38 figs., 14 tabs.

26335 (DP-MS–87-172-Rev.1) **Saltstone processing startup at the Savannah River Plant.** Wilhite, E.L.; Langton, C.A.; Sturm, H.F.; Hooker, R.L.; Occhipinti, E.S. Savannah River Lab., Aiken, SC (USA). 1988. 18p. DOE Contract AC09-76SR00001. (CONF-880839–15-Rev.1: 10. annual DOE low-level waste management conference, Denver, CO, US, August 30, 1988). Order Number DE89010458/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High-level nuclear wastes are stored in large underground tanks at the Savannah River Plant. Processing of this waste in preparation for ultimate disposal will begin in 1988. The waste will be processed to separate the high-level radioactive fraction from the low-level radioactive fraction. The separation will be made in existing waste tanks by a process combining precipitation, adsorption, and filtration. The high-level fraction will be vitrified into borosilicate glass in the Defense Waste Processing Facility (DWPF) for permanent disposal in a federal repository. The low-level fraction (decontaminated salt solution) will be mixed with a cementitious slag-flyash blend. The resulting wasteform, "saltstone," will be disposed of onsite by emplacement in an engineered facility. Waste properties, disposal facility details, and wasteform characteristics are discussed. In particular, details of saltstone processing, focusing on experience obtained from facility startup, are presented. 9 refs., 5 figs., 6 tabs.

26336 (DP-MS–88-182) **Defense waste processing facility integrated cold runs.** Gentilucci, J.A. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1989. 8p. DOE Contract AC09-76SR00001. (CONF-890207–27: Waste management '89, Tucson, AZ, US, February 26, 1989). Order Number DE89010452/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Office of Civilian Radioactive Waste Management is responsible for determining the criteria for waste acceptance at a federal repository. These requirements are contained in the Waste Acceptance Preliminary Specification (WAPS). Each waste producer is responsible for developing a Wasteform Compliance Plan (WCP) designed to meet these specifications. Data from tests described in the WCP will be reported in the Wasteform Qualification report (WQR). The WAPS contains twenty major criteria. Six of these: control of radionuclide release, verification of radionuclide release control, chemical and physical stability, free volume, free liquid, and fabrication and closure require demonstration of full-scale operation of the production facility to satisfy the WAPS documentation requirements. As the facilities are completed by Construction, they are turned over to Production to perform checkout and run-in testing using water. The support facilities such as the power and water systems are then placed online to permit testing of process facilities. Operation of the primary radioactive processing facilities using nonradioactive simulated feeds, the Integrated Cold Run Plan, will be implemented just before radioactive operation of the facility. The plan integrates the operation of the process facilities, using simulated feeds, to provide the documentation needed for the WQR while demonstrating the overall process functionality to confirm operating conditions and procedural requirements. 1 tab.

26337 (DP-MS–88-188) **The product consistency test and its role in the waste acceptance process.** Bibler, N.E.; Jantzen, C.M. Savannah River Lab., Aiken, SC (USA). 1989. 22p. DOE Contract AC09-76SR00001. (CONF-890207–26: Waste management '89, Tucson, AZ, US, February 26, 1989). Order Number DE89010421/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A crushed glass durability test, the Product Consistency Test (PCT), has been developed to meet two specifications of the Waste Acceptance Preliminary Specifications (WAPS) for nuclear waste glass produced by the Defense Waste Processing Facility (DWPF) at SRP. Specifications 1.3 and 1.4 of the WAPS require that the radionuclide release properties of DWPF glass be controlled during production, be assessed for devitrified glasses, and be assessed in a site specific repository environment. Prior to DWPF startup, the PCT will be used to define the radionuclide release properties of vitrified and devitrified glasses of the expected compositions to be produced in the DWPF. After startup, the PCT will be used on samples of the actual radioactive glass to verify that the above release properties have been controlled and have not been exceeded during production. 14 refs., 2 figs., 4 tabs.

26338 (DP-MS–88-233) **Leach tests at Savannah River Laboratory for radioactive and nonradioactive nuclear waste glasses.** Bibler, N.E.; Jantzen, C.M. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 41p. DOE Contract AC09-76SR00001. (CONF-890401–9: 197. national meeting of the American Chemical Society, Dallas, TX, US, April 9, 1989). Order Number DE89010753/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The high-level nuclear wastes currently stored at Savannah River Plant as caustic slurries will be immobilized into borosilicate glass. To characterize the glass resulting from this vitrification process, the Savannah River Laboratory (SRL) has developed and performed a variety of leach tests on both radioactive glass containing actual nuclear waste and nonradioactive glass containing simulated waste. These leach tests range from simple tests using monolithic samples in deionized water to complex tests using radioactive glass and performed remotely. Some of the tests were designed to determine the effects of factors such as radiation or groundwater oxidation potential (Eh) on the leaching process. Other tests were designed to obtain a measure of how the waste glass will respond in geologic environments. This paper describes the rationale used in the development of these tests and presents a brief survey of the tests including some of their special procedures and pertinent results. 12 refs.

26339 (DPST–88-722-TL) **DWPF [Defense Waste Processing Facility] glass sampler design.** Wehner, A.M. Savannah River Lab., Aiken, SC (USA). 8 Aug 1988. 14p. DOE Contract AC09-76SR00001. Order Number DE89010411/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Glass samples will be taken periodically in DWPF to verify the DWPF process control model. The previous DWPF reference glass sampler design consisted of a one-liter cup attached to a DWPF reference throat protector. This sampler proved to be unacceptable because it is too large, it interrupts the normal pouring operation, and the glass sample obtained cannot be easily removed from the sampling cup. A new retractable-cup glass sampler has been developed. This sampler consists of a small cup which retracts into the side of a DWPF throat protector when glass sampling is not occurring. When a sample is taken, the cup is pushed into the center of the pour stream and immediately retracted again. The glass sampler is removed from the canister at the end of the pouring operation in the same manner a reference DWPF throat protector would be removed. 2 refs., 26 figs.

26340 (DPST–88-967) **Durabiliy of two simulated nuclear waste glasses, a frit glass, and tektite in aqueous solutions: Final report, Volume I.** Hagen, D.A.; Altstetter, C.J.; Brown, S.D. Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering. May 1988. 209p. DOE Contract AC09-76SR00001. Order Number DE89010475/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

High level nuclear waste is commonly incorporated into glass for disposal. Therefore the long term aqueous durability of the waste glass is important. The leaching behavior of three simulated nuclear waste glasses (AH10, AH165, and Frit 165) and a natural glass (tektite) were examined using nuclear reaction analysis, leachate solution analysis, and microscopy. The three simulated waste glasses developed hydrated layers which increased in thickness by $t^{\frac{1}{2}}$. The hydrated layer in Frit 165 reached a constant thickness of about one micron. Alkali were preferentially removed from the Frit 165 and AH10. The tektite corroded by slow uniform dissolution. 94 refs., 68 figs., 13 tabs.

26341 (DPST–88-1194-Rev.1) **Delisting petition for filter paper take-up rolls from the 300-M liquid effluent treatment facility: Revision 1.** Sirrine Environmental Consultants, Greenville, SC (USA). Mar 1989. 398p. DOE Contract AC09-76SR00001. Order Number DE89010418/JAW. Available from NTIS, PC A17 - OSTI.

The Savannah River Operations Office of the US Department of Energy is submitting this Revised Delisting Petition to the US Environmental Protection Agency. This petition seeks exclusion from the hazardous waste regulations of 40 CFR, Part 261, for a waste byproduct classified as an F006 listed waste. Specifically, this petition seeks exclusion for spent filter paper take-up rolls, which have contacted waste water classified as an F006 waste during a pressure filtration waste treatment operation. The petition was originally submitted on August 5, 1988, and has been extensively revised following EPA comments received in October 1988. The objective of this petition is to demonstrate that the spent filter paper take-up rolls will not exceed the health-based standards for the hazardous constituents for which an F006 waste is listed. This petition contains sampling and analytical data which justify the request for exclusion. The results show that when the data are applied to the EPA Vertical and Horizontal Spread (VHS) Model, health-based standards for all waste constituents will not be exceeded during worst case operating and environmental conditions. 7 figs., 5 tabs.

26342 (DPST–89-220) **Glass fracture and DWPF product performance.** Plodinec, M.J. Savannah River Lab., Aiken, SC (USA). 20 Jan 1989. 7p. DOE Contract AC09-76SR00001. Order Number DE89010946/JAW. Available from NTIS, PC A02 - OSTI.

The waste glass produced in the DWPF will be in a fractured form inside the pour canister, due to thermal gradients during cooling, glass/canister interactions, and movement and handling. Glass surface areas may be as much as 25 times that of a monolith of the same shape and volume. In this report, the effects of glass fracture on the performance of the DWPF product, and methods of control, are reviewed. 16 refs.

26343 (DPST–89-259) **Determination of DWPF feed preparation particle simulants for TNX SRAT/SME sampling studies.** Brown, K.G. Savannah River Lab., Aiken, SC (USA). 16 Jan 1989. 9p. DOE Contract AC09-76SR00001. Order Number DE89010405/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The dopant selection for the TNX SRAT/SME sampling studies focuses on a number of factors including the fluid and particle properties and the importance of the specific insoluble species to DWPF process control and product reporting. For the SRAT sampling study, the titanate solids will be of primary concern based on process constraints. the surface active nature of these solids might make sampling them difficult as the solids tend to adhere to the inside surfaces of the vessels. Another purpose of the study will be to determine if a bias exists in the sludge solids sampling in the SRAT. A particle diameter and density will be specified that represents the sludge solids so that a dopant can be specified. This particle should have a diameter of 1–20 microns and a density of 3–4 g/ml. In general, the SRAT sampling study will provide information on the ability of the prototypic sampler to representatively sample the titanate and sludge solids as well as a soluble species. The frit solids will be the main focus of the SME sampling study. These solids are important because the silicon dioxide (SiO_2) concentration in the glass produced directly influences the three major process control/product reporting criteria (liquidus temperature, viscosity, and durability), and the SiO_2 comprises approximately 70% of the frit. Preliminary work suggests that the frit particles would be the most difficult to blend and sample in the SME due to their size and density. It has been determined that the best method to study the frit particles is to add a measured amount of doped frit to the SME. The SME sampling study will provide information on the ability of the prototypic sampler to representatively sample the frit and sludge solids as well as determining whether a bias exist in sampling either the larger or smaller particles in the tank due to the sampling velocity.

26344 (DPST–89-271) **Revised process summary bases for the DWPF [Defense Waste Processing Facility] basic data report (DPSP-80-1033, Revision 138).** Fowler, J.R. Savannah River Lab., Aiken, SC (USA). 26 Jan 1989. 60p. DOE Contract AC09-76SR00001. Order Number DE89010404/JAW. Available from NTIS, PC A04 - OSTI.

Pertinent portions of the Defense Waste Processing Facility (DWPF) Process Summary Bases have been revised to reflect the bases used in the integrated waste processing computer model as of December 1988. The model is used to calculate and generate the material balance tables for the DWPF and related waste processes. R.M. Shulko of DWPFT requested this revision to the Process Summary Bases and corresponding material balance tables be identified as Revision 138. This revision replaces many of those portions of the BDR that are now identified as Revision 90. To facilitate this revision, the various items have been labeled to reflect the new revision number.

26345 (DPST–89-309) **Effluent Treatment Facility emissions monitoring.** Taylor, R.W. Savannah River Lab., Aiken, SC (USA). 21 Feb 1989. 39p. DOE Contract AC09-76SR00001. Order Number DE89010751/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Environmental Radiometrics Group of the Environmental Technology Division, Savannah River Laboratory, monitored radionuclide effluents from two stacks of the Effluent Treatment Facility (ETF) in December 1988, and January 1989. The sampling protocol, approved by the US Environmental Protection Agency, is included in this report as the appendix. The effluents monitored were tritium oxide, radioiodine, and radionuclide bearing particulates. Each type of effluent from each stack was monitored for a period of three weeks through the isokinetic sampling ports installed when the facility was constructed. Since only one sampling port was available on the Control Building Stack, designated for the purposes of this report as Stack 1, all three types of effluent could not be collected simultaneously from each stack. 2 figs., 7 tabs.

26346 (EGG-M–29587) **Dry Rod Consolidation Technology Project results.** Mullen, C.K.; Feldman, E.M; Vinjamuri, K.; Griebenow, B.L.; Lynch, R.J.; Arave, A.E.; Hill, R.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 25p. DOE Contract AC07-76ID01570. (CONF-880354–12: Waste management '88, Tucson, AZ, US, March 1, 1988). Order Number DE89011140/JAW. Available from NTIS, PC A03 - OSTI.

The Dry Rod Consolidation Technology (DRCT) Project conducted at the Idaho National Engineering Laboratory (INEL), in 1987 demonstrated the technical feasibility of a dry horizontal fuel rod consolidation process. Fuel rods from Westinghouse 15 x 15 pressurized water reactor (PWR) spent fuel assemblies were consolidated into canisters to achieve a 2:1 volume reduction ratio. The consolidation equipment was operated at an existing hot cell complex at the INEL. The equipment was specifically designed to interface with the existing facility fuel handling and operational capabilities and was instrumented to provide data collection for process technology research. During the operational phase, data were collected from observation of the consolidation process, fuel assembly handling, and fuel rod behavior and characteristics. Equipment performance was recorded and data measurements were compiled on crud and contamination generated and spread. Fuel assembly skeletons [non-fuel bearing components (NFBC)] were gamma scanned and analyzed for isotopic content and profile. The above data collection was enhanced by extensive photograph and video documentation. The loaded consolidation fuel canisters were utilized for a test of the Transnuclear, Inc. TN-24P dry storage cask with consolidated fuel. The NFBC material was stored for a future volume reduction demonstration project. 14 figs., 4 tabs.

26347 (EGG-WM–8299) **Buried waste program retrieval process model: Revision 1.** Heiser, D.L.; Fogdall, S.P. EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1989. 173p. DOE Contract AC07-76ID01570. Order Number DE89010977/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Buried Waste Program Retrieval Process Model (BWP-RPM) was designed to provide system performance estimates and assist in the decision making process of the Retrieval Project of the Buried Waste Program. The model was developed to address queueing, scheduling, materials handling, and integration problems. A functional model of the proposed retrieval operations formed the basis of the conceptual design. From the foundation formed by the functional model, a prototype simulation model was constructed. This model has since been refined and enhanced as the Revision 1 Retrieval Process Model. The simulation model is presented through a brief discussion of the selected simulation language, its application to the BWP-RPM, and a discussion of the model itself. Detailed listings of the simulated code, and model output are included. 3 refs.

26348 (EPRI-NP–6225) **Management strategies for treatment and disposal of utility-generated low-level radioactive waste: Final report.** Murphy, E.S.; Rogers, V.C.; Bollenbacher, M.K.; Klein, R.B.; Smith, W.J. II. Electric Power Research Inst., Palo Alto, CA (USA); Rogers and Associates Engineering Corp., Salt Lake City, UT (USA). Apr 1989. 112p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Strategies for managing the low-level radioactive wastes generated at nuclear power plants are identified and evaluated for three disposal scenarios that include regional disposal capacity available, regional disposal capacity delayed, and regional disposal capacity not available for an extended period relative to the January 1, 1993 milestone of the Low-Level Radioactive Waste Policy Amendments Act of 1985. The strategies, and the options on which they are based, are evaluated with regard to six factors that include costs, health risks, environmental impacts, regulatory requirements, availability/time constraints, and public acceptance. If disposal capacity is available in the compact region, the most likely waste management strategy would include disposal of the reactor-generated LLW at the regional facility without on-site storage. Compaction or incineration of some wastes or sanitary landfill disposal of wastes with very low levels of radioactivity might be used to reduce the volumes and costs of LLW disposal. If disposal capacity is delayed but will probably become available within a relatively short period, storage of the waste for the interim period or disposal at a commercial facility in another region are likely management strategies. Volume reduction techniques or disposal of some wastes at a sanitary landfill would reduce storage or out-of-region disposal requirements. If disposal capacity is not available within the compact region and will not become available for an extended period, waste management strategies become more complex and more costly. 47 refs., 5 figs., 18 tabs.

26349 (EUR–11791) **Sol - gel inorganic ion exchangers for conditioning of medium level radioactive waste.** Arcangeli, G.; Traverso, D.M.; Gerontopoulos, P.; Fava, R. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 82p. Available from NTIS (US Sales Only), PC A05/MF A01.

Decontamination of high-level liquid wastes and medium activity wastes streams by inorganic ion exchange combined with the conversion of the spent inorganic ion exchange material to waste ceramics presents a considerable potential for utilisation in waste conditioning. Ceramic waste forms are found superior to other candidate waste immobilisation forms but practical implementation is hampered because of the complexity of the related fabrication technology. This report shows the possibility of improving this situation by resorting to sol gel techniques earlier developed for preparation of nuclear fuel ceramics. The principal findings are: - superior quality ion exchange xerogel titanates in the form of mechanically resistant, size controlled microspheres can be prepared using a simple sol-gel technique; - the titanate particles can be also used as precursors in Evaporative Deposition on Xerogel Particles (EDXP) a new waste solidification process based on physical impregnation of the xerogel material with the waste liquid followed by evaporation; - waste loaded ion exchange microspheres can be converted to leach resistant ceramics by firing and/or cold pressing and sintering at 900^0-1100^0C; - sol-gel inorganic ion exchange and EDXP may find useful application in conditioning MAW streams. 44 figs., 43 refs.

26350 (EUR–11837) **Costs and ways of financing of the geological disposal of radioactive wastes.** Venet, P.; Haijtink, B. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 296p. (In French). Available from NTIS (US Sales Only), PC A13/MF A01.

A global approach to the management of radioactive wastes must take into account not only the technological or safety aspects but also economic and financial considerations. In this study, the cost of geological disposal of radioactive wastes are initially evaluated for a certain number of representative cases of present tendencies in the European Community. These expenses comprise research, development and site validation costs, transport and interim storage costs and finally expenditure relating to various investment and exploitation phases of the disposal site as well as its closure. The possible ways of financing are subsequently reviewed and the financial charges which resulted are calculated for each considered scenario. The study is based on the most recent technical knowledge. It has been carried out by natural organizations involved in the management of radioactive wastes. ANDRA in France, CEN/SCK and ONDRAF/NIRAS in Belgium and DBE in Federal Republic of Germany on behalf of the Commission of the European Communities.

26351 (INIS-BR–1458, pp. 242) **Reactor transmutation, a utopian solution.** Elayi, A.G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIOACTIVE WASTES/plutonium isotopes; RADIOACTIVE WASTES/transmutation; TRANSMUTATION

26352 (INIS-BR–1458, pp. 228) **Radiation treatment of hazardous wastes: a preliminary survey.** Liuzzo, G. (Rome Univ. (Italy)); Tatas, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIOACTIVE WASTE PROCESSING/detoxification; FEASIBILITY STUDIES; DETOXIFICATION

26353 (INIS-BR–1458, pp. 239) **Long-term nuclear waste management: present status and alternatives.** Schapira, J.P. (Institut de Physique Nucleaire, Orsay (France)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.*

Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIOACTIVE WASTE STORAGE/spent fuel storage; FRANCE

26354 (K/ESH/FTR–1) **[IAEA consultants' meeting on radioactive waste management, Vienna, Austria, February 27–March 3, 1989]: Foreign trip report.** Mezga, L.J. Oak Ridge Gaseous Diffusion Plant, TN (USA). 20 Mar 1989. 8p. DOE Contract AC05-84OT21400. Order Number DE89010622/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler participated in the consultants' meeting resulting in the development of drafts, "Radioactive Waste Classification" and "Technical Paper in Support of the Code of Practice on Transboundary Shipments of Radioactive Wastes." In the first paper, high-, intermediate- and low-level solid, gaseous, and liquid wastes are classified according to hazard and half-life based principally upon existing IAEA classification systems. In the second paper, technical background information regarding radioactive wastes and an assessment of current transboundary shipments are provided. In addition, a series of technical principles to be considered when establishing a Code of Practice are provided.

26355 (KFK–4471) **Experimental and theoretical investigation of effects occurring during the cooling of technical HLW glass products.** Kienzler, B.; Mueller, K. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik. Feb 1989. 48p. (In German). Order Number DE89764596/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The paper presents the experimental and theoretical results from investigating the effects occurring during the cooling of HLW glass melts in canisters. It was intented to produce monolithic HLW glass blocks by controlled cooling. The experimental and numerical tools are specified and the results of measurements are compared with computed data. The influence of lining, isolation materials and crack systems in glass blocks on the heat transfer were modelled. Temperature calculations were performed for heat producing HLW glass blocks and the computed center-line temperature were analysed for various canister diameters and various conditions of interim storage. The calculations were performed by means of the finite element programs ADINA/ADINAT. For stress calculations only those volume elements were considered having temperatures below the transition temperature. A thermoelastical material model was applied. Model calculations were also performed for radioactive glass products with a thermal power of 17 W/l. The development of mechanical stresses depending on variations of heat flow from the canister surface and on change of thermal power by the radioactive decay were studied. Temperatures and arising stresses of vitrified waste forms in canister having 0.30 m and 0.43 m diameter respectively, were compared.

26356 (LA–11533-MS) **Hydrologic modeling to predict performance of shallow land burial cover designs at the Los Alamos National Laboratory.** Nyhan, J.W. Los Alamos National Lab., NM (USA). Mar 1989. 36p. DOE Contract W-7405-ENG-36. Order Number DE89011019/JAW. Available from NTIS, PC A03 - OSTI.

The water balance relationships of two shallow land burial (SLB) cover configurations were studied using a hydrologic model in a preliminary attempt to design waste disposal site covers for successful long-term closure at Los Alamos. Burial site performance requirements for site closure are first discussed, along with the role of hydrologic models in assessing the dynamics of the hydrology of the SLB cover. The calibration of a hydrologic model using field data from two SLB cover designs is then described, followed by an analysis of long-term climatic model input parameters across Los Alamos National Laboratory. These two calibrated models are then used to evaluate the influence of vegetation, precipitation, and runoff curve number on the design of SLB covers within Los Alamos county. Future directions of field research efforts and subsequent hydrologic modeling activities were recommended in terms of their usefulness for waste management decisions to be made at Los Alamos. 24 refs., 17 figs., 9 tabs.

26357 (LBL–24803) **The effect of a stationary precipitation front on nuclide dissolution and transport: Analytic solutions.** Light, W.B.; Chambre, P.L.; Lee, W.W.L.; Pigford, T.H. Lawrence Berkeley Lab., CA (USA). Feb 1988. 7p. DOE Contract AC03-76SF00098. (CONF-880903–52: Spectrum '88: international topical meeting on nuclear and hazardous waste management, Pasco, WA, US, September 11, 1988). Order Number DE89010671/JAW. Available from NTIS, PC A02 - OSTI.

Waste material in a geologic repository will dissolve and migrate away. For many components, this process will be limited by the solubility of the waste matrix and species involved. In this paper we deal with a single contaminant species and analyze the effect of a precipitation front caused by a discontinuity in the solubility of the contaminant at some distance from the waste package. The precipitation front may be due to local geochemical changes such as changes in temperature, pH or redox potential, caused by nearby geologic features or the waste itself. In contrast with other work on precipitation fronts, we provide analytic solution to the problem of precipitation at a stationary front. Numerical illustrations of these solutions are also presented. 5 refs., 2 figs.

26358 (LBL–25073) **Preliminary calculations of the effects of air and liquid water-drilling on moisture conditions in unsaturated rocks.** Bodvarsson, G.S.; Niemi, A.; Spencer, A.; Attanayake, M.P. Lawrence Berkeley Lab., CA (USA). Nov 1988. 68p. DOE Contract AC03-76SF00098;AI08-78ET44802. Order Number DE89010666/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Numerical simulation studies are performed to investigate the effects of air and liquid water drilling on the time-dependent moisture conditions in nearby fractures and rock matrix blocks. The results obtained suggest that drilling with liquid water will increase the liquid saturation in the matrix by one or two percentage points after one year of recovery. For the characteristic curves used, this corresponds to a 10 to 20 percent increase in the relative permeability of the liquid phase. The results also indicate that air drilling has negligible effects on the moisture conditions within the matrix blocks. 15 refs., 38 figs.

26359 (NUREG/CR–5089) **Numerical modeling of groundwater flow systems in the vicinity of the reference repository location, Hanford Site, Washington.** Davis, P.; Beyeler, W.; Logsdon, M.; Coleman, N.; Brinster, K. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 279p. DOE Contract AC04-76DP00789. (SAND–88-0141). Available from NTIS, PC A13/MF A01 - GPO - OSTI.

This report documents south-central Washington State's Pasco Basin ground-water modeling studies. This work was done to support the NRC's review of hydrogeologic studies under the Department of Energy's (DOE) Basalt Waste Isolation Project. The report provides a brief overview of the geology, hydrology, and hydrochemistry of the Pasco Basin as a basis for the evaluation of previous conceptual and numerical ground-water flow models of the region. Numerical models were developed to test new conceptual models of the site and to provide a means of evaluating the Department of Energy's performance assessments and proposed hydrologic testing. Regional ground-water flow modeling of an area larger than the Pasco Basin revealed that current concepts on the existence and behavior of a hydrologic barrier west of the proposed repository location are inconsistent with available data. This modeling also demonstrated that the measured pattern of hydraulic heads cannot be produced with a model that (1) has uniform layer properties over the entire domain; (2) has zones of large conductivity associated with anticlinal structures; or (3) includes recharge from the industrial disposal ponds. Adequate representation of the measured hydraulic heads was obtained with a model that contained regions of larger hydraulic conductivity that corresponded to the presence of sedimentary interbeds. In addition, a detailed model of a region smaller than the Pasco Basin was constructed to provide the NRC staff with the ability to analyze proposed Department of Energy hydrologic tests. 62 refs., 145 figs., 18 tabs.

26360 (NUREG/CR–5279) **Sulfate-attack resistance and gamma-irradiation resistance of some Portland cement based mortars.** Soo, P.; Milian, L.W. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Brookhaven National

Lab., Upton, NY (USA). Mar 1989. 39p. DOE Contract AC02-76CH00016. (BNL-NUREG–52179). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

Sulfate-attack and gamma-irradiation tests were carried out on three Portland cement mortars. For the sulfate attack work an accelerated test was used involving alternate immersion in Na_2SO_4 solution and oven drying of the samples. Attack was monitored through length-change measurements. Cement mortar containing silica fume gave unexpectedly poor resistance to attack. Reasons for this behavior are unclear. Gamma irradiation was found to cause losses in compressive strength at low doses in the 10^7 rad range. The irradiation time is a major factor in the strength-loss mechanism, whereas the dose rate is of secondary importance for the testing conditions studied. 10 refs., 19 figs., 6 tabs.

26361 (NVO–326) **Exploratory shaft location documentation report.** Gnirk, P.; Hardin, E.; Voegele, M. RE/SPEC, Inc., Albuquerque, NM (USA); Science Applications International Corp., Las Vegas, NV (USA). 21 Dec 1988. 137p. Order Number DE89010665/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The purpose of this report is to describe and document the process that involved locating, relocating, and designing the exploratory shafts for site characterization at the Yucca Mountain site. In a broad sense, the contents of the report have been developed to reflect several topics including the guidance provided by DOE-HQ to the NNWSI Project; the interaction between DOE-HQ and the NNWSI Project during the course of reaching major milestone decisions; the process and considerations that formed the basis for locating, relocating, and designing the ES(s), the review of those considerations, and the associated interface with quality assurance (QA); the interactions among DOE-HQ, the NNWSI Project, and the NRC that had impact on the location, function, and design of the ES and the exploratory shaft facility (ESF); and the impact of the course of events in the NWTS Program on the activities of the NNWSI Project since its inception in FY 1977.

26362 (PNL–5176-Add.1) **Re-evaluation of monitored retrievable storage concepts.** Fletcher, J.F.; Smith, R.I. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 150p. DOE Contract AC06-76RL01830. Order Number DE89010635/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In 1983, as a prelude to the monitored retrievable storage (MRS) facility conceptual design, the Pacific Northwest Laboratory (PNL) conducted an evaluation for the US Department of Energy (DOE) that examined alternative concepts for storing spent LWR fuel and high- level wastes from fuel reprocessing. The evaluation was made considering nine concepts for dry away-from-reactor storage. The nine concepts evaluated were: concrete storage cask, tunnel dry-well, concrete cask-in-trench, open-cycle vault, metal casks (transportable and stationary), closed-cycle vault, field drywell, and tunnel-rack vault. The purpose and scope of the re-evaluation did not require a repetition of the expert-based examinations used earlier. Instead, it was based on more detailed technical review by a small group, focusing on changes that had occurred since the initial evaluation was made. Two additional storage concepts–the water pool and the horizontal modular storage vault (NUHOMS system)–were ranked along with the original nine. The original nine concepts and the added two conceptual designs were modified as appropriate for a scenario with storage capacity for 15,000 MTU of spent fuel. Costs, area requirements, and technical and historical data pertaining to MRS storage were updated for each concept.

26363 (PNL–6772) **A detection-level hazardous waste ground-water monitoring compliance plan for the 200 areas low-level burial grounds and retrievable storage units.** Pacific Northwest Lab., Richland, WA (USA). Feb 1987. 216p. DOE Contract AC06-76RL01830. Order Number DE89011026/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This plan defines the actions needed to achieve detection-level monitoring compliance at the Hanford Site 200 Areas Low-Level Burial Grounds (LLBG) in accordance with the Resource Conservation and Recovery Act (RCRA). Compliance will be achieved through characterization of the hydrogeology and monitoring of the ground water beneath the LLBG located in the Hanford Site 200 Areas. 13 refs., 20 figs.

26364 (PNL–6852) **RCRA [Resource Conservation and Recovery Act] ground-water monitoring projects for Hanford facilities: Annual progress report for 1988.** Fruland, R.M.; Lundgren, R.E. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 84p. DOE Contract AC06-76RL01830. Order Number DE89011028/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report describes the progress during 1988 of 14 Hanford Site ground-water monitoring projects covering 16 hazardous waste facilities and 1 nonhazardous waste facility (the Solid Waste Landfill). Each of the projects is being conducted according to federal regulations based on the Resource Conservation and Recovery Act (RCRA) of 1976 and the State of Washington Administrative Code. 21 refs., 23 figs., 8 tabs.

26365 (PNL–6857) **Preliminary dose comparisons for the MRS Systems Study.** Pelto, P.J.; Lavender, J.C. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 13p. DOE Contract AC06-76RL01830. Order Number DE89011027/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report provides preliminary information on the radiological doses to the public and the workers for alternative system configurations proposed in the MRS Systems Study. Information published in the MRS Environmental Assessment (DOE 1986) was used as a basis for this analysis. The risk differences between alternative configurations were found to be small and should not be viewed as a major factor in selecting alternative configurations. 1 ref.

26366 (PNL-SA–16327) **The In Situ Vitrification Project.** Buelt, J.L. Pacific Northwest Lab., Richland, WA (USA). Oct 1988. 8p. DOE Contract AC06-76RL01830. (CONF-8810349–1: Outstanding Engineering Achievement Award meeting, Seattle, WA, US, October 1, 1988). Order Number DE89009380/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Columbia Section of the American Society of Civil Engineers (ASCE) is pleased to submit the In Situ Vitrification (ISV) Project to the Pacific Northwest Council for consideration as the Outstanding Civil Engineering Achievement. The ISV process, developed by Battelle-Northwest researchers beginning in 1980, converts contaminated soils and sludges to a glass and crystalline product. In this way it stabilizes hazardous chemical and radioactive wastes and makes them chemically inert. This report describes the process. A square array of four molybdenum electrodes is inserted into the ground to the desired treatment depth. Because soil is not electrically conductive when the moisture has been driven off, a conductive mixture of flaked graphite and glass frit is placed among the electrodes as a starter path. An electrical potential is applied to the electrodes to establish an electric current in the starter path. The resultant power heats the starter path and surrounding soil to 2000°C, well above the initial soil-melting temperature of 1100°C to 1400°C. The graphite starter path is eventually consumed by oxidation, and the current is transferred to the molten soil, which is electrically conductive. As the molten or vitrified zone grows, it incorporates radionuclides and nonvolatile hazardous elements, such as heavy metals, and destroys organic components by pyrolysis. 2 figs.

26367 (PNL-SA–16491) **Compositional analyses: Where is the uncertainty coming from?.** Pulsipher, B.A.; Eggett, D.L.; McVay, C.W.; Marlow, J.H.; Gerwitz, C.L. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 12p. DOE Contract AC06-76RL01830. (CONF-890488–2: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN, US, April 23, 1989). Order Number DE89011203/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The West Valley vitrification process is designed to solidify the high-level radioactive waste solids stored at West Valley, New York. As specified in the Waste Acceptance Preliminary Specification, an estimate of the chemical composition of the waste glass is required and an "estimate of precision and accuracy, and the basis for the estimate of the precision shall be reported in the Waste Compliance Plan." Results from a statistically designed experiment to quantify (1) short-term instrument variations, (2) long-term instrument variations, (3) short-term preparation variations, (4) long-term preparation variations, and (5) variations between replicate samples of the ground powder from a single glass sample are presented for ICP and AA analyses at West Valley. Besides determining the overall

analytical precision, statistical analyses identified which major contributors to the uncertainty should be targeted for future improvements. 1 fig., 2 tabs.

26368 (PNL-SA–16582) **Sampling and analysis strategies to support waste form qualification.** Westsik, J.H. Jr.; Pulsipher, B.A.; Eggett, D.L.; Kuhn, W.L. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 12p. DOE Contract AC06-76RL01830. (CONF-890488–5: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN, US, April 23, 1989). Order Number DE89011204/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As part of the waste acceptance process, waste form producers will be required to (1) demonstrate that their glass waste form will meet minimum specifications, (2) show that the process can be controlled to consistently produce an acceptable waste form, and (3) provide documentation that the waste form produced meets specifications. Key to the success of these endeavors is adequate sampling and chemical and radiochemical analyses of the waste streams from the waste tanks through the process to the final glass product. This paper suggests sampling and analysis strategies for meeting specific statistical objectives of (1) detection of compositions outside specification limits, (2) prediction of final glass product composition, and (3) estimation of composition in process vessels for both reporting and guiding succeeding process steps. 2 refs., 1 fig., 3 tabs.

26369 (PNL-SA–16871) **Correlation of laboratory testing and actual operations for the West Valley supernatant treatment system.** Kurath, D.E.; Bray, L.A.; Ross, W.A.; Ploetz, D.K. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 11p. DOE Contract AC06-76RL01830. (CONF-890488–4: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN, US, April 23, 1989). Order Number DE89011157/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An ion exchange process which removes Cs-137 from the supernatant liquid associated with neutralized PUREX high-level waste at the West Valley Demonstration Project was developed at the Pacific Northwest Laboratory. West Valley has now achieved initial operation of the supernatant treatment system, and results have confirmed the laboratory studies. This paper addresses the development of the predictions of system operations and the initial results of the system. 2 refs., 5 figs., 3 tabs.

26370 (PNL-SA–16887) **Vitrification process testing for reference HWVP [Hanford Waste Vitrification Plant] waste.** Perez, J.M. Jr.; Goles, R.W.; Nakaoka, R.K.; Sevigny, G.J.; Larson, D.E.; Kruger, O.L. Pacific Northwest Lab., Richland, WA (USA). Apr 1987. 17p. DOE Contract AC06-76RL01830. (CONF-890488–3: 4. international symposium on ceramics in nuclear waste management, Indianapolis, IN, US, April 23, 1989). Order Number DE89011216/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) Project is proceeding aggressively on simultaneous design and development paths. The major development goals are to (1) support design activities by providing flowsheet and equipment data necessary for design specification, (2) defining processing requirements and operation constraints, (3) performing waste form qualification activities to ensure acceptance of the canistered waste form by the federal repository, and (4) supporting site and environmental permitting activities. A reliable feedstream with consistent composition and physical properties is required to maximize throughput. The prevention of secondary phases such as spinels, insoluble alkali salts, and reduced metals is crucial to maintain a high on-stream factor and long melter life. The treatment of process off gases to maximize process recycle and eliminate environmentally harmful gases and particulate matter is a necessity. This paper focuses on liquid-fed, ceramic-lined melter and off-gas treatment equipment testing to date. Following the process description and related testing requirements, the results of melter testing with emphasis on FY 1988 test results will be presented. 4 refs., 5 figs., 7 tabs.

26371 (SAND–84-0468) **Experimental plan for investigating water movement through fractures: Yucca Mountain Project.** Klavetter, E.A.; Peters, R.R.; Schwartz, B.M. Los Alamos National Lab., NM (USA). Mar 1989. 113p. DOE Contract AC04-76DP00789. Order Number DE89010539/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Yucca Mountain site in southern Nevada is being investigated by the Nevada Nuclear Waste Storage Investigations (NNWSI) project as a possible site for a nuclear waste repository. The manner in which the water flows downward from the repository through the unsaturated zone to the water table can affect the transport of radionuclides. The travel time of water across a rock unit is considerably shorter if the flow is predominantly through fractures than if it is predominantly through the rock matrix. Current data and postulated physical models indicate that there is little or no significant flow through fractures in the unsaturated zone at Yucca Mountain. Fracture data are required to increase confidence in this conclusion and would be used qualitatively to increase understanding and quantitatively in modeling. The evaluation of water flow in fractures is also necessary for abnormal scenarios where significant fracture flow may occur because of future climatic conditions. An experimental system is described for the purpose of investigating the movement of water through fractures. The system will be used to perform the tests described in this report. 14 refs., 11 figs., 3 tabs.

26372 (SAND–85-0598) **Selected analyses to evaluate the effect of the exploratory shafts on repository performance at Yucca Mountain: Yucca Mountain Project.** Fernandez, J.A.; Hinkebein, T.E.; Case, J.B. Sandia National Labs., Albuquerque, NM (USA). Jan 1989. 270p. DOE Contract AC04-76DP00789. Order Number DE89010528/JAW. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

This report presents a number of analyses to determine whether the construction of two shafts associated with the exploratory shaft facility can significantly influence the long-term isolation capabilities of a high-level nuclear waste repository at Yucca Mountain, on and adjacent to the Nevada Test Site. Both shafts are planned to be located predominantly in fractured, welded tuff within the unsaturated zone. The calculational effort, using analytical solutions, focuses primarily on the potential influence of the shaft liner and the zone of increased rock damage around the shaft (termed in this paper the modified permeability zone, MPZ). Two mechanisms are considered in determining whether the MPZ can significantly enhance radionuclide releases. These mechanisms include water flow entering the exploratory shafts from both realistic and improbable scenarios and airflow exiting the shaft as a result of convective and barometric forces. The influence of the liner on the performance of the repository is determined by evaluating the potential chemical interaction between ground water and the concrete liner and the subsequent potential for precipitates to deposit within the MPZ and the shaft fill. It is concluded from these calculations and the current knowledge of the hydrology of the unsaturated zone at Yucca Mountain that the presence of the shafts and the associated MPZ and shaft liner do not significantly impact the long-term isolation capability of the repository. 68 refs., 54 figs., 12 tabs.

26373 (SAND–87-2833) **Review and discussion of code linkage and data flow in nuclear waste compliance assessments.** Rechard, R.P. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 140p. DOE Contract AC04-76DP00789. Order Number DE89011468/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report presents a review and discussion of data flow in a compliance assessment for high-level and transuranic waste, primarily the Containment Requirement of the Environmental Protection Agency (EPA) regulations, 40 CFR 191, Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes. Two major points concerning data flow are presented. First, assuring the quality of a compliance assessment requires that the flow of data and linkage of computer codes be well defined and precisely controlled during execution. Second, the need to analyze many different scenarios using different computer codes requires a flexible data linkage. The manner of linking codes to simultaneously provide quality assurance and flexibility is emphasized, rather than specific computer codes used. Thus, this report is not a user's guide, but a description of how a compliance assessment system was implemented in accordance with EPA regulatory guidance. Although the methods

described are general, all examples pertain to the Waste Isolation Pilot Plant project, which prompted development of the concepts. 86 refs., 40 figs., 1 tab.

26374 (SAND–88-1065) **Compilation and comparison of test-hole location surveys in the vicinity of the Waste Isolation Pilot Plant site.** Gonzales, M.M. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 266p. DOE Contract AC04-76DP00789. Order Number DE89010522/JAW. Available from NTIS, PC A12 - OSTI.

Between 1976 and 1988, many surveys were performed related to the Waste Isolation Pilot Plant and its geologic and hydrologic test holes, which are part of the hydrogeologic-characterization program. Among these surveys were two First-Order, Class I vertical surveys, a satellite survey, and a number of township-range surveys. An overview of the basic function, history, and methodology of each survey type is provided in this report along with a review and comparison of the two major test-hole surveys. Elevation and location data for 96 test holes and 4 shafts are also included. The comparison of the satellite survey to the township-range surveys showed that the latter have the following advantages: their data are more complete; their elevation data are more accurate; and their techniques can be used for surveying new wells, keeping the data set consistent. Therefore, the final township-range surveys were selected as the best source of elevation and location data to use in the WIPP hydrology program. 17 refs., 5 figs., 10 tabs.

26375 (SAND–88-1471) **Chromium distribution and transport beneath a contaminated site.** Stein, C.L.; McTigue, D.F. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 51p. DOE Contract AC04-76DP00789. Order Number DE89009696/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

For an undetermined period of years during the 1970s, liquid waste containing unspecified but significant quantities of chromium was dumped into an unlined disposal pit in surficial alluvium in the Sandia National Laboratories chemical disposal site in Technical Area III. The aluvial sediments are variable in particle size and contain lenses of gravel and/or cobbles and clay/silt layers. Mineralogy consists of quartz, illite and kaolinite, calcite, gypsum, and feldspar (mainly microcline). Depth to the water table beneath this site is approximately 145 m. A single borehole was drilled and sampled at the site in 1981. In 1983, previous workers sampled and analyzed soil from four 23-m deep holes drilled along an east-west profile across the pit. Cr was detected at that time to a depth of 15 m beneath the pit, and at a depth between 3 and 8 m at a distance 5.5 m west of the western end of the pit. In 1987 another series of holes was drilled at this site along a parallel profile offset 1.5 m to the north, and the profile was extended by the addition of three holes beyond the 1983 sampling. Cr was detected in the 1987 samples at concentrations of ~150 μg/g at a depth of 15 m directly below the pit, and ~60 μg/g at a depth of 14 m below a point 5.5 m west of the west end of the pit. The 1987 sampling showed Cr to be present at a depth of 23 m in three of the holes. Superposition of the 1983 and 1987 data shows downward migration and dispersion of Cr. 12 refs., 16 figs., 7 tabs.

26376 (SAND–88-2207) **Isostatic hot-pressing mechanism maps for pure and natural sodium chloride: Applications to nuclear waste isolation in bedded and domal salt formations.** Zeuch, D.H. Sandia National Labs., Albuquerque, NM (USA). 1989. 110p. DOE Contract AC04-76DP00789. Order Number DE89010541/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The mechanical behavior of crushed rock salt is of interest to the WIPP Project because the mined WIPP salt is a candidate material for use as backfill around the waste packages and in the underground openings during and after the operational phase. It is anticipated that in response to the convergence of the mine openings, the crushed salt will compact sufficiently to serve as an effective component in WIPP seal systems. In this report, the model for isostatic hot-pressing is applied to the problem of compaction of both pure sodium chloride and natural (WIPP) salt to develop a model capable of predicting densification rates as a function of temperature and applied pressure. Calculations for pure dry salt suggest that under conditions in situ, the contribution to densification by diffusional processes is negligible; all compaction will occur by dislocation creep. Assuming then that compaction will occur only by dislocation processes, the model is extended to nominally dry, WIPP salt. Model predictions are shown to agree favorably with limited test data, and the kinds of laboratory tests that may be done to validate the model are discussed. 78 refs., 13 figs., 2 tabs.

26377 (SAND–89-0165C) **Systems performance assessment for a Yucca Mountain repository.** Hunter, T.O.; Bingham, F.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. DOE Contract AC04-76DP00789. (CONF-890207–28: Waste management '89, Tucson, AZ, US, February 26, 1989). Order Number DE89011510/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The development of a geologic repository must include evaluations to determine whether the repository system can satisfy the regulatory requirements for postclosure waste isolation. The Yucca Mountain Project of the US DOE includes a performance-assessment program as part of this evaluation. This program focuses on developing and applying methods to determine the isolation potential of the unsaturated tuff at Yucca Mountain. The methods must be based on an understanding of the fundamental concepts of fluid flow, radionuclide releases from the engineered-barrier system, and radionuclide transport in unsaturated, fractured rock. They must be capable of addressing both expected site conditions and unexpected potentially disruptive conditions. They must ultimately be efficient enough to accommodate numerous parameters and their associated uncertainties in the development of the statistical representations that are necessary to satisfy regulatory criteria. The existing methods are based on the current information about the site but will ultimately be supported by data to be obtained during site characterization. 4 refs.

26378 (UCID–21472) **An annotated history of container candidate material selection.** McCright, R.D. Lawrence Livermore National Lab., CA (USA). Jul 1988. 62p. DOE Contract W-7405-ENG-48. Order Number DE89011340/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This paper documents events in the Nevada Nuclear Waste Storage Investigations (NNWSI) Project that have influenced the selection of metals and alloys proposed for fabrication of waste package containers for permanent disposal of high-level nuclear waste in a repository at Yucca Mountain, Nevada. The time period from 1981 to 1988 is covered in this annotated history. The history traces the candidate materials that have been considered at different stages of site characterization planning activities. At present, six candidate materials are considered and described in the 1988 Consultation Draft of the NNWSI Site Characterization Plan (SCP). The six materials are grouped into two alloy families, copper-base materials and iron to nickel-base materials with an austenitic structure. The three austenitic candidates resulted from a 1983 survey of a longer list of candidate materials; the other three candidates resulted from a special request from DOE in 1984 to evaluate copper and copper-base alloys. 24 refs., 2 tabs.

26379 (USGS/MAP/I–2018) **Geologic map of the surficial deposits of the Topopah Spring Quadrangle, Nye County, Nevada.** Swadley, W.C.; Hoover, D.L. Geological Survey, Denver, CO (USA). 1989. 16p. DOE Contract AI08-78ET44802. Available from US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225.

This document consists of a single map without supporting text. (TEM)

26380 (WHC-EP–0182-11) **Tank farm surveillance and waste status summary report for February 1989.** Thurman, J.M. Westinghouse Hanford Co., Richland, WA (USA). Apr 1989. 47p. DOE Contract AC06-87RL10930. Order Number DE89011102/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks, as well as to provide supplemental information regarding tank equipment, tank anomalies, and ongoing investigations.

26381 (WHC-EP-0257) **Final draft Resource Conservation and Recovery Act interim status assessment of thirteen facilities.** Crane, P.J. Westinghouse Hanford Co., Richland, WA (USA). Apr 1989. 141p. DOE Contract AC06-87RL10930. Order Number DE89010853/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In support the commitment to achieve regulatory compliance with Resource Conservation and recovery Act interim status facility standards, the compliance status of 13 Hanford Site dangerous waste facilities under interim status has been assessed. None of the 13 facilities assessed presently receive dangerous waste; however, two actively manage dangerous waste from past operations. The remaining facilities may contain waste residues from past operations. The current operations at each facility were assessed for compliance with the existing Washington State Department of Ecology Dangerous Waste Regulations. Specific corrective action guidance is provided to correct noncompliant items noted during the assessment, although recommendations are made for a limited compliance program at facilities not managing dangerous waste. The facilities covered include the 100-D Ponds, 105-DR Sodium Fire Facility, 183-H Solar Evaporation Basins, 1706-KE Treatment and Storage Facility, 200 West Ash Pit, 216-S-10 Pond and Ditch, 216-U-12 crib, 2101-M Pond, 2727-S Storage Facility, 300 Area Solvent Evaporator, 304 concretion Facility, E-8 Borrow Pit and the Hexone Tanks.

26382 (WHC-SA-0104) **Product characteristics of transuranic waste immobilized in grout.** Greenhalgh, W.O.; Cash, R.J.; Christie, M.A. Westinghouse Hanford Co., Richland, WA (USA). Jan 1988. 11p. DOE Contract AC06-87RL10930. (CONF-880354-11: Waste management '88, Tucson, AZ, US, March 1, 1988). Order Number DE89011045/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Laboratory and drum-sized specimens of simulated processed Hanford TRU waste termed shred/grout were tested for WIPP-WAC compliance for various compositions. Most test compositions were found to meet WIPP criteria. Other waste tests were conducted including 10 CFR-61 and selected 10 CFR-71 tests. A typical shred/grout composition was shown to exhibit excellent performance against WIPP and other waste tests. As a result of the testing, shred/grout is recommended as an acceptable form for processed Hanford TRU wastes designated for WIPP disposal. 4 refs., 5 figs., 5 tabs.

26383 (WHC-SA-0218) **Transuranic removal from neutralized current acid waste with pneumatic hydropulse filtration.** Simmons, F.M. Westinghouse Hanford Co., Richland, WA (USA). Jun 1988. 5p. DOE Contract AC06-87RL10930. (CONF-880903-50: Spectrum '88: international topical meeting on nuclear and hazardous waste management, Pasco, WA, US, September 11, 1988). Order Number DE89010100/JAW. Available from NTIS, PC A02 - OSTI.

Neutralized current acid waste (NCAW) is generated by the solvent extraction portion of the PUREX process. It contains <20% solids by volume, and is currently stored in underground tanks at Hanford. These solids contain the transuranic (TRU) elements and most of the fission products and will be converted to glass for permanent disposal. Because of the high cost of vitrification and repository disposal, there is a large economic incentive to minimize volume. Separation of the solids from the supernatant liquor provides a more concentrated high-level waste stream for vitrification, thereby reducing the cost. Removal of the solids will also provide an approximately TRU-free supernatant liquor which can be disposed of as grout in near-surface facilities. Allowing the solids to settle, then decanting (settle/decant) and filtering the supernatant are the principal unit operations used for TRU removal. 3 figs.

26384 Ground-water hydraulics of the deep-basin brine aquifer, Palo Duro Basin, Texas panhandle. Smith, D.A. (Univ. of Texas, Austin (USA)). *Geological Society of America, Abstracts with Programs (USA)*, 17: 720 (1985). (CONF-8510489--: 98. annual meeting of the Geological Society of America, Orlando, FL, US, October 28, 1985).

The Deep-Basin Brine aquifer of the Palo Duro Basin (Texas Panhandle) underlies thick Permian bedded evaporites that are being evaluated as a potential high-level nuclear waste isolation repository. Potentiometric surface maps of 5 units of the Deep-Basin Brine aquifer were drawn using drill-stem test (DST) pressure data, which were analyzed by a geostatistical technique (kriging) to smooth the large variation in the data. The potentiometric surface maps indicate that the Deep-Basin Brine aquifer could be conceptually modeled as 5 aquifer units; a Lower Permian (Wolfcamp) aquifer, upper and lower Pennsylvanian aquifers, a pre-Pennsylvanian aquifer, and a Pennsylvanian to Wolfcampian granite-wash aquifer. The hydraulic head maps indicate that ground-water flow in each of the units is west to east with a minor northerly component near the Amarillo Uplift, the northern structural boundary of the basin. The Wolfcamp potentiometric surface indicates the strongest component of northerly flow. Inferred flow direction in Pennsylvanian aquifers is easterly, and in the pre-Pennsylvanian aquifer near its pinch-out in the basin center, flow is inferred to be to the north. In the granite-wash aquifer the inferred flow direction is east across the northern edge of the basin and southeast along the Amarillo Uplift.

0530 Environmental Aspects

Refer also to citation(s) 26322, 26325, 26326, 26327, 26328, 26329, 26330, 26331, 26333, 26334, 26335, 26336, 26339, 26341, 26344, 26345, 26346, 26348, 26356, 26357, 26358, 26359, 26361, 26363, 26364, 26366, 26367, 26371, 26372, 26373, 26374, 26375, 26376, 26377, 26378, 26379, 26381, 26382, 26383, 26386, 26387, 26388, 26872

26385 (K/TR-89/3) **Tests of UF_6 emission into the atmosphere: Interpretation of results.** Crabol, B.; Deville-Cavelin, G. Oak Ridge Gaseous Diffusion Plant, TN (USA). 1989. 16p. Translation of report DAS/SASC, October 1988. DOE Contract AC05-84OT21400. Order Number DE89010131/JAW. Available from NTIS, PC A03 - OSTI.

The specific purpose of the experimental program presented in [1] was to gain a better knowledge of the important phenomena of the behavior of UF_6 released in a gaseous form into the atmosphere so that these phenomena could be modeled. The specific questions we attempted to answer were as follows: Speed of hydrolysis of UF_6 (that is, decomposition of UF_6 to UO_2F_2 and HF by the water vapor in the atmosphere), vertical movement of the plume at its exit (elevation of the plume because of the exothermy of the hydrolysis reaction, deformation because of its high density), physical-chemical forms of the products of hydrolysis (hydration, polymerization, formation of mixed compounds), grain size distribution and rate of ground deposit of these products. This research presents an interpretation of the results of the April 10, 1987 test (a so-called validation test), attempting specifically to show how these results make it possible to answer the questions above. 5 refs., 8 figs.

0540 Health and Safety

Refer also to citation(s) 26586, 27057, 27678

26386 (ANL/EES-TM-370) **The effects of a perturbed source on contaminant transport near the Weldon Spring quarry.** Tomasko, D. Argonne National Lab., IL (USA). Mar 1989. 36p. DOE Contract W-31109-ENG-38. Order Number DE89010543/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effects of a perturbed contamination source at the Weldon Spring quarry in St. Charles County, Missouri, on downstream solute concentrations were investigated using one-dimensional analytical solutions to an advection-dispersion equation developed for both constant-strength and multiple-stepped source functions. A sensitivity study using parameter base-case values and ranges consistent with the geologic conceptualization of the quarry area indicates that the parameters having the greatest effect on predicted concentrations are the distance from the quarry to the point of interest, the average linear groundwater velocity, the contaminant retardation coefficient, and the amplitude and duration of the source perturbation caused by response action activities. Use of base-case parameter value and realistic values for the amplitude and duration of the source perturbation produced a small effect on solute concentrations near the western extremity of the nearby municipal well field, as well as small uncertainties in the predicted results for the assumed model. The effect of simplifying assumptions made in deriving the analytic solution is unknown: use of a multidimensional

flow and transport model and additional field work are needed to validate the model. 13 refs., 18 figs.

26387 (BNL–42339) **Report of technical support for the Hazardous Waste Remedial Action Program on health and environmental risks of inactive hazardous waste sites.** Morris, S.C.; Meinhold, A.F. Brookhaven National Lab., Upton, NY (USA). Aug 1988. 39p. DOE Contract AC02-76CH00016. Order Number DE89010495/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report interprets the Hazard Potential Index (HPI), an approach for ranking hazardous waste sites. The relationship of the HPI with health effects and health risk, and its application and limitations as a health-risk guide for setting funding priorities for remedial action at Department of Energy Defense Programs inactive hazardous waste sites are explored. The report details sources of uncertainties and focuses on methods to evaluate uncertainties in the HPI. It investigates the time factor in the HPI. It is concluded that the HPI is inadequate in itself for setting priorities for corrective action at hazardous waste sites, but the information system from which the HPI is calculated and intermediate productions of that calculation which are not currently reported would provide a stronger basis for decision-making. Recommendations are provided for going beyond the HPI in compiling information for decision-making. 6 refs., 3 tabs.

26388 (NUREG–0904-Suppl.1-Vol.2) **Supplement to the Final Environmental Statement related to the decommissioning of the Rare Earths Facility, West Chicago, Illinois (Docket No. 40-2061): Volume 2, Appendix H.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards. Apr 1989. 950p. Available from NTIS, PC A99/MF A01 - GPO - OSTI.

This Supplement to the Final Environmental Statement is issued by the US Nuclear Regulatory Commission in response to the Atomic Safety and Licensing Board's ruling that the staff must supplement the Final Environmental Statement in order to evaluate the impact of permanent disposal of the Kerr-McGee Rare Earths Facility wastes located at West Chicago, Illinois. The statement considers the Kerr-McGee preferred plan and various alternatives to the plan. The action proposed by the Commission is the renewal of the Kerr-McGee license to allow disposal of wastes onsite and for possession of the wastes under license for an indeterminate time. The license could be terminated at a later date if certain specified requirements were met. NUREG-0904 was published in draft for comment in June 1987. Comments have been received and are published with their responses in this report. Volume 1 contains the main text and Appendices A thru G. Volume 2 contains the comments received and their responses.

26389 (PB–89-858740/XAB) **Accident risks in nuclear facilities. January 1984-April 1988 (Citations from the NTIS data base). Report for January 1984-April 1988.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 180p. Available from NTIS PC N01/MF N01.

See also PB–89-858757.

This bibliography contains citations concerning risk analysis and hazards evaluation of the design, construction, and operation of nuclear facilities, including the risk and hazards of transporting radioactive materials to and from these facilities. Radiological calculations for environmental effects of nuclear accidents and the utilzation of computer models in risk analysis are also included. (This updated bibliography contains 368 citations, none of which are new entries to the previous edition.)

26390 (PB–89-858757/XAB) **Accident risks in nuclear facilities. May 1988-April 1989 (Citations from the NTIS data base). Report for May 1988-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 74p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-863188. See also PB–89-858740.

This bibliography contains citations concerning risk analysis and hazards evaluation of the design, construction, and operation of nuclear facilities, including the risk and hazards of transporting radioactive materials to and from these facilities. Radiological calculations for environmental effects of nuclear accidents and the utilzation of computer models in risk analysis are also included. (This updated bibliography contains 102 citations, all of which are new entries to the previous edition.)

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 26317, 27057

26391 (Juel-Spez–471) **Game theoretical analysis of safeguards effectiveness. Pt. 2. Variables sampling.** Avenhaus, R.; Canty, M.J. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft. Oct 1988. 33p. Order Number DE89764693/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The discussion of non-sequential random inspections begun in Part I is extended here to include the possibility of false alarms. A randomization of inspection activities is assumed in which in general only a subset of the paths are inspected. The problem of calculating a guaranteed detection probability for diversion along an arbitrary path is considered. Useful analytical solutions are again obtained for various assumptions regarding inspection resource constraints and false alarm probabilities.

26392 (LA–11569-M) **Fundamentals of materials accounting for nuclear safeguards.** Pillay, K.K.S. (comp.). Los Alamos National Lab., NM (USA). Apr 1989. 380p. DOE Contract W-7405-ENG-36. Order Number DE89010766/JAW. Available from NTIS, PC A17/MF A01 - OSTI; GPO Dep.

Materials accounting is essential to providing the necessary assurance for verifying the effectiveness of a safeguards system. The use of measurements, analyses, records, and reports to maintain knowledge of the quantities of nuclear material present in a defined area of a facility and the use of physical inventories and materials balances to verify the presence of special nuclear materials are collectively known as materials accounting for nuclear safeguards. This manual, prepared as part of the resource materials for the Safeguards Technology Training Program of the US Department of Energy, addresses fundamental aspects of materials accounting, enriching and complementing them with the first-hand experiences of authors from varied disciplines. The topics range from highly technical subjects to site-specific system designs and policy discussions. This collection of papers is prepared by more than 25 professionals from the nuclear safeguards field. Representing research institutions, industries, and regulatory agencies, the authors create a unique resource for the annual course titled "Materials Accounting for Nuclear Safeguards," which is offered at the Los Alamos National Laboratory.

26393 (NRC–9010605) **Material control and accounting in the Department of Energy's nuclear fuel complex.** National Research Council, Washington, DC (USA). Committee on Material Control and Accounting. 1989. 103p. Order Number DE89010605/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Material control and accounting takes place within an envelope of activities related to safeguards and security, as well as to safety, health, and environment, all of which need to be managed to assure that the entire nuclear fuel complex can operate in a societally accepted manner. Within this envelope the committee was directed to carry out the following scope of work: (1) Review the MC&A systems in use at selected DOE facilities that are processing special nuclear material (SNM) in various physical and chemical forms. (2) Design and convene a workshop for senior representatives from each of DOE's facilities on the flows and inventories of nuclear materials. (3) Plan and conduct a series of site visits to each of the facilities to observe first hand the processing operations and the related MC&A systems. (4) Review the potential improvement in overall safeguard systems effectiveness, as measured by expected reduction in inventory difference control limits and inventory differences for materials balance accounts and facilities, or other criteria as appropriate. Indicate how this affects the relative degree of uncertainty in the system. (5) Review the efficiency of operating the MC&A system with and without the upgrading options and assess whether upgrading will contribute further efficiencies in operation, which may reduce many of the current operations costs. Determine

if the current system is cost-effective. (6) Recommend the most promising technical approaches for further development by DOE and further study as warranted.

26394 (NUREG–0430-Vol.9-No.1) **Licensed fuel facility status report: Inventory difference data, January 1988–June 1988.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards. Mar 1989. 14p. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

NRC is committed to the periodic publication of licensed fuel facilities' inventory difference data, after Agency review of the information and completion of any related investigations. Information in this report includes inventory difference data for active fuel fabrication facilities possessing more than (i) one effective kilogram of special nuclear material of low strategic significance, (ii) one effective kilogram of special nuclear material of moderate strategic significance, (iii) one effective kilogram of strategic special nuclear material contained in irradiated fuel reprocessing operations, or (iv) five formula kilograms of strategic special nuclear material.

26395 (NUREG/CR–5081) **Tactical exercise planning handbook.** Telfair, W.D.; Moul, D.A.; Klingehoefer, J.W.; Leonard, W.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation; Battelle Columbus Div., OH (USA). Apr 1989. 141p. (BMI–2162). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

This Handbook provides guidance for the development, conduct, evaluation, and critique of security force tactical response exercises. Background information pertinent to the development of the Handbook and the intent of rulemaking that revises 10 CFR Part 73 to require tactical response exercises is provided. Step-by-step instructions on exercise development, conduct, evaluation, and critique are furnished to assist licensees in meeting regulatory requirements. Needs and resource requirements estimates are addressed in terms of personnel, staff-hours, equipment, weapons, and ammunition. Appendices provide examples of all documents required to plan, conduct, critique, and evaluate the exercises.

26396 (NUREG/CR–5172) **Tactical training reference manual.** Telfair, W.D.; Moul, D.A.; Klingelhoefer, J.W.; Jurjevich, K.M.; Leonard, W.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation; Battelle Columbus Div., OH (USA). Apr 1989. 285p. (BMI–2166). Available from NTIS, PC A13/MF A01 - GPO - OSTI.

This Manual provides training information for US Nuclear Regulatory Commission licensees to assist in implementation of the Tactical Response Team (TRT) training and exercise requirements of the revised portions of 10 CFR Part 73, which requires that licensees possessing formula quantities of strategic special nuclear material establish TRTs and conduct tactical response exercises to enhance the capabilities of security forces in protecting NRC licensed fuel facilities from potential adversaries postulated in the design basis threat. Step-by-step illustrated instructional material is provided concerning both individual and team tactics and skills appropriate to meeting these requirements. The Manual consists of two parts. Part One addresses adversary attributes and essential tactical skills that each TRT member should master to assure personal safety and effective response to adversary actions. Part Two discusses more advanced tactics, command, control, and orders. 30 refs., 281 figs.

0560 Legislation and Regulations

Refer also to citation(s) 26324

26397 (PNL–3594-Rev.9) **International nuclear cycle fact book: Revision 9.** Leigh, I.W. Pacific Northwest Lab., Richland, WA (USA). Jan 1989. 252p. DOE Contract AC06-76RL01830. Order Number DE89011333/JAW. Available from NTIS, PC A12 - OSTI.

The International Nuclear Fuel Cycle Fact Book has been compiled in an effort to provide current data concerning fuel cycle and waste management facilities, R and D programs and key personnel. The Fact Book contains: national summaries in which a section for each country which summarizes nuclear policy, describes organizational relationships and provides addresses, names of key personnel, and facilities information; and international agencies in which a section for each of the international agencies which has significant fuel cycle involvement, and a listing of nuclear societies. The national summaries, in addition to the data described above, feature a small map for each country as well as some general information. The latter is presented from the perspective of the Fact Book user in the United States.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

26398 (DOE/ET/33006–036) **Plasma Separation Process: Nickel-63 production demonstration.** TRW Space and Technology Group, Redondo Beach, CA (USA). Apr 1989. 50p. DOE Contract AC03-77ET33006. (PSP–1913). Order Number DE89010929/JAW. Available from NTIS, PC A03 - OSTI.

This document describes the processing of nickel samples previously enriched in nickel-62 to form beta emitting thin layer specimens with an isotopic abundance in excess of 10% nickel-63. The operations performed to produce nickel-63 served as a demonstration of the capability to ultimately produce large quantities (kilograms per year) of nickel-63 for use in long life betacell batteries. Both isotopic enrichment and neutron irradiation facilities are required to produce the desired product. The enriched nickel-62 was produced utilizing the Plasma Separation Process facility at TRW, the irradiation of the nickel-62 and subsequent chemical processing of the nickel-63 described in this report was performed by Oak Ridge National Laboratory (ORNL) using the high flux irradiation reactor. Approximately 83 copper coupons plated with nickel containing 11.6% nickel-63 with thicknesses ranging from 0.25 microns to 2.0 microns were produced during the program. These results together with the previously reported PSP enrichment capability (Ref: Nickel Production Demonstration Report, PSP-R1-1348, November 1987) provide a clear demonstration of the process production readiness. 2 refs., 8 figs.

0702 Radiation Sources

Refer also to citation(s) 26389, 26390

26399 (INIS-BR–1458, pp. 208) **Statistical error in on-line thickness calibration by radiation transmission.** Oyedele, J.A. (Obafemi Awolowo Univ., Ile-Ife (Nigeria). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MATERIALS/calibration; MATERIALS/thickness; ON-LINE MEASUREMENT SYSTEMS/calibration; ON-LINE MEASUREMENT SYSTEMS/thickness; ERRORS; MATERIALS; CALIBRATION; THICKNESS; RADIATION SOURCES

26400 (INIS-BR–1458, pp. 200) **Scattered X-ray beam nondestructive testing.** Harding, G. (Philips Forschungslaboratorium G.m.b.H., Hamburg (Germany, F.R.)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X-RAY DIFFRACTION/image scanners; X-RAY DIFFRACTION/industry; X-RAY DIFFRACTION/nondestructive testing; PATTERN RECOGNITION; SMALL ANGLE SCATTERING; USES; INDUSTRY

26401 (LA–11576-MS) **A portable 10-MeV electron linear accelerator as a neutron camera.** Morgado, R.E. Los Alamos National Lab., NM (USA). May 1989. 25p. DOE Contract W-7405-ENG-36. Order Number DE89010684/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present the results of a literature search into the present state-of-the-art techniques in producing, moderating, collimating, and imaging thermal neutrons, with an emphasis on radiographic

diagnosis. The portable linear accelerator source we describe compares favorably with commercially available laboratory facilities for neutron production, while surpassing existing sources in portability. 16 refs., 10 figs., 4 tabs.

0703 Isotopic Power Supplies

26402 (PB–89-901900/XAB) **Government research and development summaries: Nuclear, Te, Ti Project Briefs. Monthly report.** CSR, Inc., Washington, DC (USA). Power Information Center. 1989. a Available from NTIS Subscription.

Supersedes PB–88-901900. Paper copy available on subscription, $80.00/year. U.S. sales only, excluding embassies. Additional subject categories available at a discount. Also available in single copies.

Nuclear, Te, Ti Project Briefs describe the status of all R&D program submitted to the Power Information Center by the government sponsors in energy conversion from fission, fusion, and radioisotope power sources and other thermal systems that use thermionic systems. These briefs also follow related investigations of plasma dynamics. The document is not to be reproduced, in whole or in part, for dissemination outside your own organization nor may it be reproduced for advertising or sales promotion purposes.

08 HYDROGEN

Refer also to citation(s) 26631

0801 Production

26403 (DOE/MC/23287–T6) **A novel approach to hydrogen recovery, storage and transport: Task 1, Technical plan.** Fowler, M.C. United Technologies Research Center, East Hartford, CT (USA). Jul 1988. 21p. DOE Contract AC21-87MC23287. Order Number DE88014990/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The obtaining of high purity hydrogen from the coal gasification process is a series of chemical reactions, several of which require reactant preparation/purification. At any point in the process, it would be useful to have a chemical separation system which can purify the product hydrogen and store it in convenient form. The purpose of this research program is to evaluate one such candidate system, the catalytically reversible hydrogenation of an aromatic hydrocarbon, toluene, to its corresponding cyclical paraffin, methylcyclohexane. Reversible hydrogenation, kinetics, and dehydrogenation is discussed. 5 refs., 4 figs.

0808 Properties

Refer also to citation(s) 26279

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

Refer also to citation(s) 26202, 26220, 26422, 26434

26404 (CONF-8901100–2) **Landfill gas generation and migration: Review of current research II.** Bogner, J.; Vogt, M.; Piorkowski, R. Argonne National Lab., IL (USA). 1989. 25p. DOE Contract W-31109-ENG-38. From Solar Energy Research Institute (SERI) anaerobic digestion review meeting; Golden, CO, US; January 25, 1989. Order Number DE89009821/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

With regard to gas migration, a field investigation is examining bidirectional gas movement through landfill cover materials by processes of pressure and diffusional flow. The overall purpose of the study is to quantify gas loss from the landfill reservoir by natural venting and air influx due to pumping on recovery wells. Two field sites–a humid site, with vegetated clay cover and a semiarid site with unvegetated sandy silt cover–have been instrumented to examine vertical gas movement through cover materials. Results from the past year's work at the semiarid site indicates that rates of CH_4 flux out of the landfill surface may be as high as 2×10^{-6} g cm^{-2} sec^{-1} (6.3×10^2 Kg m^{-1} yr^{-1}) during dry soil conditions. Such high rates represent both the loss of an energy resource and a significance factor in global warming trends since atmospheric CH_4 contributes to the greenhouse effect. An independent estimate has suggested that 8–15% of global atmospheric CH_4 is attributable to landfill sources. The second project is addressing landfill gas generation. The major goal is to develop simple assay techniques to examine the gas production potential of landfilled refuse. Refuse samples extracted from various depths in a landfill are being subjected to Biochemical Methane Production (BMP) assays with periodic qualitative examination of microbial populations. Triplicate assays of unamended refuse (controls) are compared to assays with added moisture, nutrients, and bacterial seed. To date, moisture addition is the single most important variable in stimulating gas production, particularly in samples with visible soil content. 56 refs., 2 figs., 3 tabs.

26405 (CRIQ–MAT-88-032) **Conversion of synthesis gas to distillate over ironborosilicate zeolites. Final report.** Leen, K.; Chang, J.R. Centre de Recherche Industrielle du Quebec, Sainte-Foy, PQ (Canada). 1988. 147p. (MICROLOG–88-05986). Available from Centre de recherche industrielle du Quebec, 333 rue Franquet, CP 9038, Sainte-Foy, PQ, Canada G1V 4C7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The work carried out within the framework of this project has focused mainly on the modification of a proprietary mulitfunctional crystalline ironborosilicate zeolite, designated as ZKQ-IB4A, for the purpose of maximizing premium grade diesel production from synthesis gas. Twelve catalysts prepared by modifying the base zeolite with Na, Co and La, Ru, and Zn were each tested in a small fixed-bed tubular reactor. The results point to the likely existence of an optimum Na concentration for maximizing liquid hydrocarbon yield. Co, Na-exchanged and La-impregnated base zeolite was found to be highly selective to diesel range hydrocarbons, whereas Ru-impregnated base zeolite was found to actually decrease activity. Catalytic activity and selectivity were affected by Sterotex, which was admixed with the catalyst prior to pelletization. On the basis of the results obtained, the possibility of using modified ZKQ-IB4A catalysts in a process that could advantageously compete with the MO6D process is suggested. 54 refs., 32 figs., 29 tabs.

26406 (DOE/PC/70029–T2) **Fischer-Tropsch quarterly report for period ending January 31, 1986.** Louisville Univ. Research Foundation, Inc., KY (USA). 1986. 8p. DOE Contract AC22-84PC70029. Order Number DE89010727/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex of many reactions. Among those that have been demonstrated to occur on the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products such as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporation in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labeled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. During this quarter, runs were made with unlabeled ethanol and pentanol. The change in products between sample collection periods when alcohol was added to the CO/H_2 and when only CO/H_2 were present clearly indicated that alcohols were incorporated into higher carbon products. 5 figs.

26407 (DOE/PC/70029–T3) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for period ending June 30, 1986.** Louisville Univ. Research Foundation, Inc., KY (USA). 1986. 6p. DOE Contract AC22-84PC70029. Order Number DE89010736/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex combination of many reactions. Among those that have been demonstrated to occur on

the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products such as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporation in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labeled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. Difficulties were encountered in our efforts to measure the amount of ^{14}C in the higher carbon liquid products (C_6 and higher) but they have now been overcome. Only 15%, or less, of the ^{14}C added to the reactor during a 24 hour period was incorporated into the non-oxygenated components. Liquid chromatographic separation, following separation into alkene and alkane fractions by dry column silica gel chromatography, permitted collection of samples corresponding to each of the normal alkanes between C_9 and C_{15}. The refractive index detector permitted quantitative determination of the amount of each n-alkane collected. The ^{14}C content of each n-alkane fraction was determined by liquid scintillation counting. 4 figs.

26408 (DOE/PC/70029–T4) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for the period ending September 30, 1986): Applications of ^{14}C tracer techniques to the study of reactions occurring over iron-based Fischer-Tropsch catalysts.** Louisville Univ. Research Foundation, Inc., KY (USA). 1986. 23p. DOE Contract AC22-84PC70029. Order Number DE89010735/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex combination of many reactions. Among those that have been demonstrated to occur on the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products such as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporation in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labeled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. During the past quarter, attention has been focused largely on determining the fate of the ^{14}C in labeled alcohols added to the synthesis reaction over 10% Fe/SiO_2 and United Catalyst's C-73 (Fe-K-Al-Ca-Si) catalysts. 8 refs., 12 figs., 2 tabs.

26409 (DOE/PC/70029–T5) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for the period ending December 30, 1986.** Louisville Univ. Research Foundation, Inc., KY (USA). 1986. 13p. DOE Contract AC22-84PC70029. Order Number DE89010734/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of iron-based catalysts containing irreducible oxides as additives will be prepared and tested. The additives tested in this reporting period include aluminum, silicon, thorium and zirconium, added in amounts representing 0.6-0.7 wt.% of the catalyst. The remainder of these catalysts in all cases was Fe_2O_3, prepared by precipitation of the hydroxide followed by calcination. In addition to the catalyst testing, significant effort was devoted to the investigation of two related topics. One was residence time phenomena in the slurry reactors and the other was tracer studies of the chemistry of alcohols and olefins added to the synthesis reaction. An understanding of residence time phenomena, particularly the transients which occur when conditions are changed, is essential to a proper interpretation of the reaction chemistry. The tracer studies have revealed some unexpected chemistry. 5 figs., 2 tabs.

26410 (DOE/PC/70029–T6) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for the period ending March 31, 1987.** Louisville Univ. Research Foundation, Inc., KY (USA). 1987. 37p. DOE Contract AC22-84PC70029. Order Number DE89010733/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex combination of many reactions. Among those that have been demonstrated to occur on the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products such as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporation in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labeled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. The results presented in this paper utilized [1-^{14}C]-1-pentanol as the label. Product separations were utilized in order to evaluate the ^{14}C distribution in alkene and alkane components over a range of carbon numbers. Results pertaining to the two alpha values are presented in this paper. 21 refs., 13 figs.

26411 (DOE/PC/70029–T8) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for the period ending June 30, 1987: Fischer-Tropsch synthesis: Comparison of product selectivity and ^{14}C labeled ethanol incorporation at one and seven atmosphere conditions.** Louisville Univ. Research Foundation, Inc., KY (USA). 1987. 14p. DOE Contract AC22-84PC70029. Order Number DE89010731/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex combination of many reactions. Among those that have been demonstrated to occur on the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporates in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labeled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. During this past quarter attention has been focused largely on determining the fate of the ^{14}C in labeled ethanol added to the synthesis reaction over iron catalyst. 28 refs., 9 figs., 1 tab.

26412 (DOE/PC/70029–T9) **Mechanism of promotion of iron Fischer-Tropsch catalysts: Quarterly report for period ending March 31, 1986.** Louisville Univ. Research Foundation, Inc., KY (USA). 1986. 43p. DOE Contract AC22-84PC70029. Order Number DE89010832/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fischer-Tropsch reaction is a complex combination of many reactions. Among those that have been demonstrated to occur on the catalyst surface are CO dissociation, build-up of carbon chains by a polymerization process, desorption of products such as olefins and oxygen-containing compounds, water formation and its subsequent shift reaction to form CO_2, olefin hydrogenation, isomerization and reincorporation in the synthesis and, probably, other reactions yet to be identified and studied. The tracer technique, involving the feeding of ^{14}C-labled compounds to the synthesis, is being used here in an effort to learn how catalyst additives and supports influence these reactions and determine the final product distribution. ^{14}C labeled ethanol, when added to a CO/H_2 feed, undergoes dehydrogenation to establish essentially an equilibrium ethanol-acetaldehyde mixture. However, under the reaction conditions used, ethyl acetate and 1,1-diethoxyethane (actual) are significant products; the ^{14}C label permits use to identify these products as being derived from ethanol. In addition, it appears that aldol condensation of acetaldehyde occurs to a minor extent. 28 refs., 17 figs., 1 tab.

26413 (ETSU-L–26) **UK landfill gas and municipal solid waste digestion industry.** Richards, K.M. Energy Technology Support Unit, Harwell (UK). 1988. 40p. Order Number DE89762697/JAW. Available from NTIS (US Sales Only), PC A03.

In the UK more than 90% of all generated wastes are eventually disposed of to landfill. The biodegradable portions of the waste invariably decompose and produce a methane rich landfill gas. This gas can be exploited and a growing industry is evolving to take advantage of such a novel source of renewable energy. Gas exploitation also encourages and assists in the environmental control of landfill gas, a key aspect in the future of the technology. Ultimately, to maximise both environmental and energy control of the decomposition of refuse, fabricated 'digesters' may need to be

used. Such a forward strategy has considerable implications for both the waste collection and waste disposal industry in the UK.

26414 (ETSU-L-27) **UK Department of Energy R and D (biofuels) programme for landfill gas.** Lawson, P.S. UKAEA Harwell Lab. (UK). Energy Technology Div. [1988]. 20p. Order Number DE89762559/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Through the Department of Energy's Energy Efficiency Demonstration Scheme the use of landfill gas as an economic energy source has been successfully demonstrated. Projected estimates indicate that, using current technology, the UK landfill gas resource could reach 1 million tonnes of coal equivalent per annum (mtcepa) by the turn of the century. These estimates are based on currently reported landfill gas yields which average 135m^3 per tonne of refuse. However, theoretical yields of landfill gas indicate a potential yield of 400 m^3 per tonne of refuse. The reasons for the threefold difference between current and theoretical yields need to be investigated if the full potential of landfill gas as an energy resource is to be realised. It is probable that a number of factors are important such as the biological mechanisms of landfill gas production; abstraction and utilization technology; management of landfill sites; and the characteristics of each site. Consequently the Department of Energy (DEn) has recognised the need for a comprehensive R and D programme with the prime objective of cost effective optimisation of landfill gas yield. This paper details the DEn's current R and D programme in this area and examines the proposed expansion of R and D on the mechanisms of landfill gas production.

26415 (PB-89-151393/XAB) **Comparative evaluation of mesophilic and thermophilic anaerobic digestion. Phase 1. Temperature-transition studies. Research report, October 1984-April 1986.** Kugelman, I.J.; Guida, V.G. Lehigh Univ., Bethlehem, PA (USA). Jan 1989. 75p. Available from NTIS, PC A04/MF A01.

See also Phase 2, PB-89-151401.

A study of the operation of anaerobic systems under temperature transition was conducted as part of a larger study of mesophilic vs. thermophilic anaerobic digestion. Systems seeded with domestic sewage sludge, but subsequently fed a chemically defined complex medium, were operated at 20- and 30-day detention times at 35 C. The temperature was raised to 55 C at rates varying from 0.25 C to 2.5 C per day. As soon as the temperature exceeded 45 C methane production shut down; the units were held at 45 C until recovery occurred. Once recovery of methane production ability occurred, transition to 55 C took place with little incident. The rate of temperature rise had little effect on the total time required to obtain stable operation at 55 C; detention time had a minor effect with longer detention time yielding superior results. Studies of temperature drop and steady-state comparison between mesophilic and thermophilic operation also were conducted.

26416 (PB-89-151401/XAB) **Comparative evaluation of mesophilic and thermophilic anaerobic digestion. Phase 2. Steady state studies. Research report, September 1983-August 1987.** Kugelman, I.J.; Guida, V.G. Lehigh Univ., Bethlehem, PA (USA). Jan 1989. 63p. Available from NTIS, PC A04/MF A01.

See also Phase 1, PB-89-151393.

A study was conducted of the relative performance of anaerobic digestion systems under mesophilic and thermophilic conditions. Fifty liter laboratory scale digesters were fed primary sludge from the Allentown, PA Waste Water Treatment Plant. Long-term, steady-state performance data were obtained at 49.5 and 35^{0}C. Two hydraulic detention times, 25 days and 15 days, were used. Operation of the mesophilic and thermophilic units was within parameter ranges normally considered satisfactory. Mesophilic operation was superior to thermophilic operation total and volatile solids breakdown, gas production, and breakdown of carbohydrate, oil, and grease. Thermophilic breakdown of organic nitrogen was superior. Dewaterability of sludge produced under mesophilic conditions also was better than under thermophilic conditions.

26417 (PB-89-159917/XAB) **Identification and characterization of reaction steps and enzyme catalysts involved in the conversion of acetate and methyl groups to methane. Annual report, October 1985-October 1986.** Stadtman, T.C.; Grahame, D.A. National Heart, Lung, and Blood Inst., Bethesda, MD (USA). Oct 1986. 85p. Available from NTIS, PC A05/MF A01.

See also PB-86-154531.

Large quantities of purified carbon monoxide dehydrogenase (CODH) were obtained from acetate-grown cells of Methanosarcina barkeri by scaling-up the purification procedure which the authors developed in 1985. Studies on the pure enzyme demonstrated that it has an alpha 2 beta 2 oligomeric structure composed of subunits with molecular weights of 19,700 and 84,500. Analysis of the metal-ion content indicated 1.3 plus or minus 0.3 (n=4) Ni and 15.6 plus or minus 5.6 (n=5) Fe per mol alpha 2 beta 2. Dialysis against EDTA did not reduce the content of these metals. The enzyme did not contain Co or Mo. The amino acid compositions of the subunits were determined. The enzyme did not catalyze isotopic exchange between (1-14C)-acetyl-CoA and CO. Ferredoxin, FAD, FMN, 2,3,5-triphenyltetrazolium chloride (TTC), methyl viologen, and phenazine methosulfate served as electron acceptors; however, the enzyme did not reduce NAD+, NADP+, or the 8-hydroxy-5-deazaflavin factor F(sub 420). A higher degree of thermostability was noted in the absence than in the presence of CO. Pure CODH from Methanococcus vannielii was also found to be an alpha 2 beta 2 oligomer composed of subunits which were similar in molecular weights to the subunits of M. barkeri CODH.

26418 (SAND-89-0269) **Investigation of fuel production using metalloporphyrin-based complexes as catalysts and electron-transfer intermediates: Annual report, April 1987-December 1988.** Shelnutt, J.A. Sandia National Labs., Albuquerque, NM (USA). Jan 1989. 44p. DOE Contract AC04-76DP00789. (GRI-89/0040). Order Number DE89011321/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Metalloporphyrins have appropriate properties for photosensitizing and catalysts solar energy storage reactions. Fundamental spectroscopic studies of metalloporphyrins and related enzymes that carry out C_1 chemistry can identify the factors controlling reactivity of the metal complexes. Research has concentrated on mimicking biological methanogenesis through investigation of the enzyme methylreductase, which carries out the final step in the reduction of Co_2 to methane. Transient and difference Raman spectroscopies were used to investigate the structural features of methylreductase, its nickel-hydrocorphin Cofactor F_{430}, and hydrocorphin and porphrin analogs of the active nickel complex. in particular, axial ligation at the nickel site was evaluated under a variety of conditions with the goal of elucidating the mechanism of methane synthesis. Studies of the tin-and antimony-porphyrin photoredox cycles were also carried out as possible solar-driven sources of reductant for biomimetic methane generation. 1 ref., 1 fig.

26419 **CH_4 concentration imaging in simple jet and bluff-body flames.** Schefer, R.W. (Sandia National Labs., Livermore, CA (US)); Namazian, M.; Kelly, J.; Long, M.B. pp. 283-288 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541-: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

Instantaneous planar images of the CH_4 concentration in simple-jet and bluff-body stabilized flames were obtained by collecting Raman-scattered light perpendicular to a thin sheet of laser light passed through the axis of the flame. The instantaneous images were averaged to obtain mean and fluctuating statistics and probability distributions of the CH_4 concentration. The time-resolved planar images reveal flow and mixing structure information that is lost when time-averaged and instantaneous point measurement techniques are used. Fuel-jet flow and mixing in simple jet and bluff-body stabilized flames are characterized by large-scale irregular and time-varying structures that engulf external fluid. Downstream of the bluff-body face, the fuel jet is stagnated and spread in the radial direction by the dynamics of the high-velocity external air flow. This stagnation process governs how fuel and air mix and subsequently combust in these flames and determines the major differences between simple-jet and bluff-body flames.

0902 Alcohol Fuels

Refer also to citation(s) 26436

26420 (CANMET–MRL-88-33-TR) **Safety of conventional fuel pumps and fuel level indicators in fuel tanks of road vehicles using alcohol fuels.** Bossert, J.A.; Dainty, E. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario (Canada). 1988. 16p. (In English and French). (MICROLOG–89-00964). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1986, the Road Safety Directorate of Transport Canada contracted Celanese Canada Inc. to perform and study the safety aspects of Alcohol fuels in Road Vehicles. This study included such things as autoignition temperature, limits of flammability, flame luminosity, miscibility with water, analysis of headscape vapours, incidents of fires and firefighting considerations. The contractor was unable to perform one important study, the safety of in-tank fuels pumps and fuel level gauges in the presence of alcohol fuels, so the Canadian Explosive Atmospheres Laboratory were asked to undertake this study. The headspace of a fuel tank containing gasoline contains a saturated mixture of vapour and air which is above the upper limit of flammability down to approximately -40^{0}C. Therefore, a spark in the fuel tank caused by a faulty electrical component is not likely to cause an explosion. Methanol, on the other hand, will produce an ignitable vapour, in its saturated state, at approximately 11^{0}C. Mixtures of methanol and gasoline were found to have flash points somewhere between these two figures. In this study, several different fuels and three electrical devices normally found in fuel tanks of gasoline powered automobiles were tested to determine the safety of these devices in automobiles power by methanol and methanol/gasoline blends. This is Phase II of the Transport Canada study and is supplementary to the report on Phase I by Celanese Canada Inc. 3 refs, 5 figs., 1 tab.

26421 (DOE/ER/13604–7) **Study of synthesis gas conversion over metal oxides: Progress report, August 1, 1988–January 31, 1989.** Ekerdt, J.G. Texas Univ., Austin, TX (USA). Jan 1989. 28p. DOE Contract FG05-86ER13604. Order Number DE89011492/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goals of our program are to develop an understanding of the causes for catalytic activity and selectivity, and an understanding of the effects of metal oxide structure and acidic and basic additives on CO hydrogenation over metal oxides. The program has concentrated on zirconium dioxide systems and has: (1) identified the structure of adsorbed C_1 fragments, (2) used oxygen isotopes to establish the reaction mechanisms for methanol and methane synthesis from synthesis gas, (3) used ^{13}C-labelled reactants to establish the complex reaction mechanisms (CO insertion into adsorbed aldehydes and condensation between methoxide and η^3-enolates) by which higher molecular weight hydrocarbons and alcohols are formed, (4) identified lattice oxygen vacancies as the active site for CO adsorption and conversion into methoxide as well as the site for C_1 synthesis, and (5) investigated the role of basic and acidic surface sites in stabilizing key intermediates in the synthesis of higher weight products. 19 refs., 11 figs., 2 tbs.

26422 (DOE/PC/90013–T7) **Optimum catalytic process for alcohol fuels from syngas: Seventh quarterly technical progress report.** Union Carbide Corp., South Charleston, WV (USA). 29 Oct 1988. 53p. DOE Contract AC22-86PC90013. Order Number DE89010787/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objectives of this contract are to discover and evaluate the catalytic properties of novel homogeneous, heterogeneous, or combination catalytic systems for the production of alcohol fuel extenders from syngas, to evaluate analytically and on the bench scale novel reactor concepts for use in converting syngas to liquid fuel products, and to develop on the bench scale the best combination of chemistry, reactor, and total process configuration to achieve the minimum product cost for conversion of syngas to liquid fuel products. Catalysts investigated include: ruthenium and molybdenum sulfides impregnated with cobalt. 7 figs., 9 tabs.

26423 (PB–89-155675/XAB) **Ethanol and US agriculture. Agriculture information bulletin.** Kane, S.; LeBlanc, M. Economic Research Service, Washington, DC (USA). Resources and Technology Div. Jan 1989. 10p. (USDA/AIB–559). Available from NTIS, PC A02/MF A01.

Ethanol produced from grain is viewed by many as a way to reduce energy imports, levels of carbon monoxide in the air, and surplus grain stocks. Federal and State governments helped to establish the fuel-ethanol industry by providing direct payments, tax exemptions, and loan guarantees. Future policy decisions could significantly affect ethanol production and demand. Treatment of ethanol in agricultural policy is made difficult by its ties to energy, environmental, and trade policy. The bulletin provides a basis for assessing the contribution of ethanol production to national objectives.

0904 Solid Waste and Wood Fuels

Refer also to citation(s) 26247, 26914, 26915

26424 (CONF-8904197–1) **A review of refuse-derived fuel (RDF) facilities: Design considerations and opportunities.** Ohlsson, O.O. Argonne National Lab., IL (USA). 1989. 32p. DOE Contract W-31109-ENG-38. From The energy/chemistry conference; Cairo, EG; April 1, 1989. Order Number DE89010695/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the history of refuse-derived fuel (RDF) processing facilities in the United States. The advantages and limitations of these systems are compared to mass burning technology. The current status of these facilities, including environmental, institutional, and economic considerations, are discussed. The unit operations used to produce a desired RDF product are described and the future potential of RDF processing systems is evaluated. Current research sponsored by the US Department of Energy on new RDF processing techniques is presented. 14 refs., 15 figs., 9 tabs.

26425 (IEC–1987) **Design a tree chip drying system. Part 2 of 2.** Cringan, J.C.; Isles, R.; Burrell, C. Intertech Engineering Corp., Toronto, ON (Canada). 1987. 323p. (MICROLOG–89-00771; CE–02566). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes the technical and economic details of a design process to achieve an energy efficient wood chip dryer. The nature of the work centered on the design of heat recovery techniques to minimize the energy consumption of a wood chip dryer, and then the optimization of the system under varying conditions of operation in order to determine and compare the real cost of drying wood chips on a unit energy delivered basis. 21 refs., 10 figs., 15 tabs.

26426 (IEC–1987) **Design a tree chip drying system. Part 1 of 2.** Cringan, J.C.; Isles, R.; Burrell, C. Intertech Engineering Corp., Toronto, ON (Canada). 1987. 323p. (MICROLOG–89-00771; CE–02567). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Intertech Engineering Corporation has carried out a study on the design of a tree chip drying system, in accordance with a contract issued by the Department of Energy, Mines and Resources. The objectives of the work are: design and selection of a drying system for wood chips to obtain the lowest cost per tonne of dried product; determination of the drying characteristics of a wood chip dryer in terms of energy required to remove a pound of water at various operating conditions of the dryer, product and atmosphere; determination of the real cost of drying wood chips on a cost net unit energy delivery basis as compared to costs of wet chips; verification of chip drying characteristics by bench tests; estimation of costs involved in transportation, storage, etc.; and calculation of fuel burning efficiencies and heating costs. The work was carried out by evaluation of the state of the art, preliminary designs, calculation of mass and energy flour balances, detailed design and capital and cost estimates. A computer program was designed to carry out the optimization of the performance of the dryer. the results show that a medium temperature, atmospheric dryer of the regeneration type

can be built with a coefficient of performance of between 4 and 5. This means that, for every heat energy unit used in the process, there will be a 4 to 5 fold increase in the heating value of the wood chips, within the range of drying from 50% to 25% moisture. In addition, this technique, if applied correctly, could be utilized in the drying of all sorts of biomass material. In the specific case of woodchips, the total energy required to remove 1 lb of water from wet chips is in the range of 350 Btu. In appendices of this report are: a report, Bench Tests on the Drying of Tree Chips (fixed and fluidized bed); and a computer code for the optimization of a tree chip dryer. 11 refs., 33 figs., 14 tabs.

26427 (MKL-JULK–741) **Fuelwood production in farms.** Kinanen, M. (ed.). Maatalouskeskusten Liitto, Helsinki (Finland); Maatalouden Tutkimuskeskus, Jokioinen (Finland). Dec 1986. 75p. (In Finnish). Order Number DE88757298/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Also known as the report Tieto Tuottamaan 43.

In Finland the logging wastes and small wood which do not fulfill the quality requirements and minimum measures are an important fuel wood reserve. The aim of this guide is to give information of the energy use of wood in farms. The guide deals with energy wood reserves in Finland, the requirements for fuel wood. It also deals with harvesting, production and storage of fuel wood, the economy of fuel wood production, the possibilities to increase the consumption of fuel wood and education and advising.

26428 (SI–1-1988) **Comminution and application of forest wood residues.** Baadsgaard-Jensen, J. Skovteknisk Inst., Copenhagen (Denmark). 1988. 57p. (In Danish, English). Available from Skovteknisk Institut, Amalievej 20, DK-1875 Frederiksberg C.

The report covers the comminution of wood into small pieces shorter than 25cms. These are used mainly for the production of energy, pulp and board products. An evaluation of which comminution processes will give results preferred by industries of the future is presented. It is surmised that particles that are significantly longer than they are thick and wide will be favoured. Chunking machines are predicted to be of special future interest, and new machines which are about to be commercialized are described. Chunk is found to be more easily storageable and a better fuel for most types of boilers. It presents no problems regarding removal of bark and foliage, and it is deemed possible to save transport costs by carrying out the comminution process in the forest. Chunks can be raw material for chips, flakes and strands etc. Chunkers (machinery for chunk cutting) should be capable of cutting chunks of varying lengths and should be able to accept continuous feeding as uniformity is an important property in regard to industrial requirements. (AB) 28 refs.

13 HYDRO ENERGY

1301 Resources and Availability

Refer also to citation(s) 27332

1303 Plant Design and Operation

26429 (EFI-TR–3427) **Network methods in operation planning of hydroelectric power systems. Models and basic programs available at EFI.** Gjelsvik, A. Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway). Jun 1987. 88p. (In Norwegian). Order Number DE88757293/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report contains descriptions of two general optimization programs for network models, which are available at Elektrisitetsforsyningens Forskningsinstitutt (EFI). By means of examples, a survey is given of the use of network models for optimization of the operation of hydroelectric power plants. 17 refs., 11 figs., 2 tabs.

26430 (EFI-TR–3474) **State control in hydroelectric power plants. Hydraulic loss monitoring.** Nielsen, T.K.; Sandvik, J.A.; Skarstein, Oe. Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway). Dec 1987. 260p. (In Norwegian). Order Number DE88757294/JAW. Available from NTIS (US Sales Only), PC A12/MF A01.

The report describes a method of monitoring the hydraulic losses in a hydroelectric power plant. By means of measurements in the water way, of the electric power, inflow and water level, the flow of water and loss coefficients of the water way and the turbine are estimeated. The method, which applies the extended Kalman filter and Bayesian hypothesis testing, can also be used to detect faults in the sensors. The model is general. Specific adaption has been made to the Graasjoe power plant, where complete instrumentation has been installed. The goal of this instrumentation is to gain operational experience with sensors and remote measuring equipment, specially designed for an on-line monitoring of the water way and the production capacity. The conclusion is that the method is effective. The operational experiences will only be available after a test period, which will be outside the time limit of this project. 13 refs., 35 figs.

26431 (EPRI-GS–6365) **Guidelines for drilling and testing core samples at concrete gravity dams: Final report.** Meisenheimer, J.K. Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Denver, CO (USA). May 1989. 104p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

These guidelines are intended to provide a standardized approach to collecting reliable data on uplift pressure measurements and concrete and foundation properties of concrete gravity dams. The data can be used by dam owners, consultants, and regulatory agencies to develop realistic assumptions for use in performing site-specific stability analyses. In many cases, site specific data may be obtained through investigations to demonstrate that a dam has adequate stability. An investigation to determine actual uplift pressures and interface strengths would include core drilling, installation of piezometers, and laboratory testing of samples. Regulatory agencies will accept site data when the investigations are performed carefully so that the data obtained are reliable and representative of in-situ foundation conditions. These guidelines provide a basis for dam owners to develop and perform quality investigations to establish appropriate design criteria. Separate sections discuss methods of core drilling to obtain and preserve good quality samples, installation of piezometers to measure uplift, and laboratory testing of concrete and rock samples. The guide presents field exploration procedures which can be incorporated into the investigation to provide a more complete picture of concrete and rock integrity. Recommendations are provided for the selection of equipment and methods to obtain good quality results. Sources of more detailed information are referenced. 23 refs., 20 figs., 3 *abs.

1306 Environmental Aspects

26432 (DOE/BP/22493–2) **Kokanee stock status and contribution of Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1986.** Bowles, E.C.; Ellis, V.L.; Hatch, D.; Irving, D.; Holm, F. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Idaho Dept. of Fish and Game, Boise, ID (USA). Feb 1987. 65p. DOE Contract AI79-85BP22493. Order Number DE89011521/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Estimated kokanee (Oncorhynchus nerka) abundance in Lake Pend Oreille was 4.3 million during September 1986. This estimate was similar to 1985 and indicates continued suppression of the kokanee population since initial decline in the late 1960s. Atypically high survival of wild fry resulted in similar fry recruitment in 1986 as 1985, whereas hatchery-reared fry contributed only 8% to total fry recruitment as a result of low post-release survival (3%). Fry released into the Clark Fork River from Cabinet Gorge Hatchery had very low survival during emigration to Lake Pend Oreille, resulting from poor flow conditions and potentially high predation. Fry survival during emigration was twice as high during nighttime flows of 16,000 cfs than 7,800 cfs. Emigration also was faster during higher flows. Several marks were tested to differentially mark fry release groups to help determine impacts of flow and other factors on fry survival. Survival of fry marked with tetracycline and fluorescent dye was high (>99%) during the 10-week study. In contrast, survival of fry marked with fluorescent grit marks ranged from 5 to 93%, depending on application pressure and distance from the fry. Retention was high (>96%) for tetracycline and grit marks during the

study, whereas dye marks were discernible (100%) for only one week. 23 refs., 20 figs., 10 tabs.

26433 (DOE/BP/39641–4) **Effect of operation of Kerr and Hungry Horse Dams on the reproductive success of kokanee in the flathead system: Annual progress report FY 1986.** Beattie, W.; Clancey, P. Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (USA). Mar 1987. 73p. DOE Contract AI79-83BP39641. Order Number DE89011523/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The 1985 kokanee spawning run in the Flathead system was the strongest in five years. Escapement to the Flathead River system was 147,000 fish, including 123,000 in McDonald Creek and an estimated 20,000 in the main stem. Enumeration of spawners and redds in the Flathead River was hindered by high fall flows early freezing in November. The upstream spawning migration from Flathead Lake began in late August. Schools of kokanee were seen six miles above the lake on September 4. We counted 1156 redds in Flathead Lake, distributed primarily along the southeastern shore. An unusually high proportion (90 percent) of lakeshore spawning occurred in the zone above minimum pool, where egg mortality is very high because of exposure from drawdown. Escapement to the Swan River was 1350 fish. Four year old (III+) fish comprised 95 percent of the spawning run in the Flathead system. This continues a five-year trend toward dominance of the III+ year class. The age composition of spawners has varied considerably for the past 15 years. The average size of spawning fish was 365 mm, which is identical to the average size of the parent year class in 1981. One of the goals of managing Flathead kokanee is to produce mature fish 300-330 mm in length. 26 refs., 16 figs., 9 tabs.

14 SOLAR ENERGY

Refer also to citation(s) 26619

1401 Resources and Availability

Refer also to citation(s) 27373

1403 Economics

Refer also to citation(s) 26449

1405 Solar Energy Conversion

Refer also to citation(s) 26247, 26413, 26414, 26427, 26428, 26807, 27183, 27315

26434 (DLG–538010) **Energy conservation and energy recovery in animal farming. Papers.** Deutsche Landwirtschafts-Gesellschaft e.V., Frankfurt am Main (Germany, F.R.). 1980. 57p. (In German). (CONF-8006281–1: 13. meeting of the WG for environmental, health and nutrition aspects of animal production, Celle, DE, June 12, 1980). Order Number DE89764691/JAW. Available from NTIS (US Sales Only), PC A04.

Agricultural biogas plants and energy recovery systems are described. Utilisation of these energies requires a sophisticated technology which results in high plant costs. The economic efficiency of biogas plants depends on the biogas volume and utilisation rate. Safety measures, storage and utilisation of excess gas volumes are gone into.

26435 (DOE/CE/15337–T6) **[Edge illuminated vertical multijunction]: Sixth quarterly report, January 1, 1989–March 31, 1989.** Sater, B.L. Sater (Bernard), Olmsted Falls, OH (USA). 1989. 4p. DOE Contract FG01-87CE15337. Order Number DE89010903/JAW. Available from NTIS, PC A02 - OSTI.

SOLAR CELLS/optimization; PROGRESS REPORT; OPTIMIZATION; FABRICATION; CARRIERS; CARRIER LIFETIME; COATINGS; TESTING; DOPED MATERIALS; DIFFUSION; ION IMPLANTATION

26436 (DOE/ER/13233–T1) **[Studies of the genetics regulation of the thermomonospora cellulose complex]: Progress report, 1 February 1988–15 January 1989.** Cornell Univ., Ithaca, NY (USA). 1989. 4p. DOE Contract FG02-84ER13233. Order Number DE89010493/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the past year we have made major progress in determining the sequence of our cloned T. fusca cellulase genes. At this time we have completed the sequence of the genes coding for enzymes E2 and E5 and started sequencing the genes coding for E1 and for part of E4. There are still a few minor uncertainties in the E2 and E5 sequences due to their high G,C content, but we have established open reading frames that code for proteins of the appropriate size, encode the N terminal sequence determined from the purified proteins and that have the amino acid composition that was determined for each purified protein. Interestingly there is no significant homology between the E2 and E5 genes. Furthermore there was no real homology between the two genes and any sequence in Gen Bank which includes seven cellulase genes. 5 refs.

26437 (DOE/ER/13455–3) **Femtosecond studies of electron transfer processes at semiconductor interfaces: Progress report.** Rochester Univ., NY (USA). [1989]. 6p. DOE Contract FG02-85ER13455. Order Number DE89010599/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The major emphasis of this research program has been to determine the mechanism of electron transfer at an abrupt phase discontinuity defined by a conducting surface. The key issue is the strength of the electronic coupling between the delocalized band states and the electronic levels of an adsorbed molecule on the surface. The use of semiconductor liquid junctions provides an ideal system for addressing this question. Optical excitation at above band gap wavelengths can be used to prepare the system at the adiabatic crossing point for electron transfer, i.e., directly at the transition state. This method enables a femtosecond view of the time evolution of the transition state. In the past year, we have examined the carrier reaction dynamics at (100) GaAs single crystal surfaces. The major focus has been on determining the fundamental surface state trapping rate constants at oxide induced surface states. This is the main competing channel for direct interfacial charge transfer and needs to be fully characterized. The key question in the case of surface state trapping are: (1) What is the mechanism of electronic coupling between surface traps and the band states and (2) What is the time scale for the trapping. 5 refs.

26438 (DOE/ER/13743–2) **Unraveling Photosystem II: Progress report, February 1, 1988–January 31, 1989.** Bogorad, L. Harvard Univ., Cambridge, MA (USA). 1989. 4p. DOE Contract FG02-87ER13743. Order Number DE89010930/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project identifies and characterizes protein components of the energy-transducing reaction centers in photosynthetic membranes to understand how these components are arranged and function in the membrane. One question involves whether open reading frames found in chloroplast DNA sequences in fact encode proteins of the photosynthetic apparatus and, if so, to determine where the proteins function. A new protein subunit of the cytochrome b_6/f electron transport complex has been identified in the course of this work. Another approach to identifying, characterizing and establishing the role of proteins of the photosynthetic apparatus has been to generate photosynthetic mutants of the facultatively heterotrophic single-celled cyanobacterium Synechocystis PCC6803 and then to identify DNA sequences that correct the mutant phenotype. Cyanobacteria are relatively simple organisms that carry out the same type of oxygen-evolving photosynthesis as chloroplasts of higher green plants but they are more convenient for certain experiments. Mutants studied to date in this part of the program have had deficiencies in chlorophyll-proteins associated with the reaction center of Photosystem II. Such mutants have been very useful in revealing the sources of certain fluorescence emission bands in the photosynthetic apparatus and thus helping understand the transfer of energy within these systems. Sets of mutants with other genetic lesions are being analyzed.

26439 (DOE/OR/21390–23) **Great Lakes Regional Biomass Energy Program: Quarterly report, December 1, 1988–February 28, 1989.** Kuzel, F. Council of Great Lakes Governors, Chicago, IL (USA). Mar 1989. 18p. DOE Contract FG05-83OR21390. Order

Number DE89010830/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the second quarterly report of the sixth year of operation of the Great Lakes Regional Biomass Energy Program. The program was initiated in 1983 with a grant to the Council of Great Lakes Governors from the Biofuels and Municipal Waste Technology Division of the US Department of Energy. Stressing near-term biomass feedstock production techniques and conversion processes, the objective of the program is to increase the use of biomass energy by the public and private sectors in the seven state Great Lakes region. States that are in the Great Lakes region include: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin.

26440 (DTH-EI-LHT–208) **Development of reproduceable, cheap, highly efficient solar cells. TS - status report.** Safir, Y.; Proctor, W.G.; Leistiko, O. Danmarks Tekniske Hoejskole, Lyngby. Elektronisk Inst. Oct 1987. 39p. (In Danish). Order Number DE88757290/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Emphasis has been laid on the development of a technology for the production of solar cells which are not only cheap and easily reproducable but also have a very high rate of efficiency. Three publications, which have been utilized to disseminate information to prospective manufacturers, have also been included. (AB) 10 refs.

26441 (FERIC–SR-16) **Logging residue survey and the line transect method. A comparison of field and photo methods.** Forest Engineering Research Inst. of Canada, Pointe Claire, PQ (Canada). 1981. 17p. (CE–02500). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

There has always been an interest in the assessment for use of slash or residue from logging operations, although traditionally it has been with slash as a fuel for forest fires. The increasing costs of energy have changed this to an interest in the residues for the production of energy. This study selected a representative area in eastern Canada that had been logged by conventional methods. Residue was sampled by reliable, established techniques, then repeated on large-scale aerial photographs using a system proven in operational forest inventories. Experimental methods are described and the accuracy in diameter estimation achieved was analyzed for errors in individual diameter measurements, photo interpretation bias, observations missed by the photo interpretor, and the impact of these errors on the estimate of residue volume. The use of the line transect method was evaluated in conjunction with aerial photography and although the estimates of the total volume were less from photogrammetric data than from ground measurements, they were more consistent. The technique offers further advantages in speed and opportunity for reinventory but is limited to fresh, unilayered residue. A recommended procedure is also presented, as well as the cost of a typical residue survey. 16 refs., 3 figs., 4 tabs.

26442 (IEACG–1987) **Development of a strategic plan for bioenergy division information and technology transfer.** IEA Consulting Group Ltd., Charlottetown, Prince Edward Island (Canada). 1987. 51p. (MICROLOG–89-00768; CE–02564). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this study is to develop a strategic plan for information and technology transfer in the Bioenergy Division (BED) of the Renewable Energy Branch. Information was obtained from a literature search from available studies from within Energy, Mines and Resources Canada and from interviews with officials. Technology transfer is the process of facilitating the commercialization of a potential application of technology. It is suggested that the roll of the BED is to shepherd selected technologies through to the stage of market acceptance. Technologies to be supported should be those for which a large enough potential market application exists to justify a business investment to supply the product upon its successful completion of R&D and demonstration stages. The focus of the BED should therefore be on prospective applications of technology (PAT). Information transfer is a subset of activities within technology transfer and consists of communications initiatives that address specific awareness and attitudinal barriers that may exist at any of the stages of the commercialization process. The steps to develop a strategic plan for information and technology transfer within the BED are outlined. 14 refs., 10 tabs.

26443 (OAF/AE–300-20) **Two-year growth and biomass yield of hybrid poplar. Preliminary report.** Van Hooren, D.L.; Columbus, M.J. Ontario Ministry of Agriculture and Food, Toronto (Canada). Agricultural Energy Centre. 1987. 20p. (MICROLOG–89-01128; CE–02579). Available from Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Hybrid poplar is being investigated to determine its potential as a renewable and dependable source of fuel energy for a greenhouse operation. In May of 1984, six clones of hybrid poplar were planted. After two years of growth, the main stem diameter of the different clones ranged from 1.6 cm to 3.1 cm, while the main stem height ranged from 175 cm to 361 cm. In April of 1986, the clones were harvested with a modified corn forage harvester. The moisture content of the tree biomass at harvest ranged from 55% to 61%. The biomass yield of the different clones ranged from 2.10 to 7.69 oven dry tonnes/ha. Monitoring will be continued to determine the regenerative growth of the hybrid poplar and biomass yield of future harvestings. 1 ref., 3 figs., 6 tabs.

26444 (PB–89-165559/XAB) **Nitrogen fertilizer and sewage-sludge effects on hybrid poplars. Final report.** Riha, S.R.; Senesac, G.P.; Naylor, L. Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Engineering. Sep 1984. 92p. Available from NTIS, PC A05/MF A01.

The major objective of the project was to assess the impact of alternative sources of fertilizer on the growth of hybrid poplars. Interest in increasing the production of woody biomass for pulp, chips, fuel, and energy fuel stock has led to the cultivation of hybrid poplar in short-rotation intensive-cultivation systems. Hybrid poplars root easily from cuttings, grow quickly in the early stages of their life cycle, and can be coppiced. Species and varieties of poplars have been hybridized to produce clones that are adapted to a range of site conditions and are resistant to certain diseases. Highest biomass production is obtained under cultivated, fertilized, well-watered and well-drained conditions. Initial studies seem to indicate that poplar clones with larger root biomass can compete more effectively with weeds, and still increase nutrient and heavy-metal uptake.

26445 (SERI/STR–211-3447) **Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Final report, October 1, 1983–January 31, 1987.** Delahoy, A.E.; Eser, E.; Kampas, F.; Lenskold, R. Solar Energy Research Inst., Golden, CO (USA); Chronar Corp., Princeton, NJ (USA). Mar 1989. 114p. DOE Contract AC02-83CH10093. Order Number DE89000893/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report contains results of research designed to fabricate single-junction p-i-n solar cells with 12% efficiency at air-mass 1 with an area of about 1 cm^2 and submodules of interconnected single-junction cells with 8% efficiency and areas of about 1000 cm^2. An objective was to control light-induced degradation to less than 2% over 720 hours of AMI illumination. A secondary objective was to design, construct, and operate a multichamber deposition system that would deposit p-i-n cells over an area of 1000 cm^2. The best efficiency obtained was 10.8% with a small-area cell (0.08 cm^2). The best stabilities and efficiencies were obtained with conventional p-i-n a-SiC:H/a-Si:H heterostructures, p-i-n/p-i-n tandem cells, and structures containing transitional affinity-graded i-layers. Small- and large-area efficiencies stayed below performance goals by about 1%, however. The multichamber deposition system was designed and operated, but a problem remained with boron contamination of the i-layer that should be investigated further. 23 refs., 53 figs., 19 tabs.

26446 (SERI/STR–211-3448) **Investigations of the origins of metastable, light-induced changes in hydrogenated amorphous silicon: Final subcontract report, 1 February 1986–30 March 1988.** Cohen, J.D. Oregon Univ., Eugene, OR (USA). Dept. of Physics. Mar 1989. 37p. DOE Contract AC02-83CH10093. Order

Number DE89000890/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report contains results of Phase II of research to investigate metastable defect creation processes in hydrogenated amorphous silicon. The study relied primarily on junction capacitance methods to monitor the changes in deep defect distribution. Results obtained applying capacitance profiling methods to the study of undoped samples are summarized and indicate a significant role of extrinsic impurities in the degree of light-induced degradation that occurred. Photocapacitance transient measurements were taken to investigate changes in undoped a-Si:H. Studies were also begun of metastable changes in n-type doped a-Si:H samples by using both the drive-level capacitance profiling technique and transient photocapacitance methods, and results are described. 22 refs., 10 figs., 1 tab.

26447 (SERI/STR–211-3450) **High-efficiency, large-area CdTe panels: Annual report, June 1987–June 1988.** Albright, S.P.; Singh, V.P.; Ackerman, B. Solar Energy Research Inst., Golden, CO (USA); Photon Energy, Inc., El Paso, TX (USA). Apr 1989. 43p. DOE Contract AC02-83CH10093. Order Number DE89000891/JAW. Available from NTIS, PC A03 - OSTI.

This technical progress report on large-area CdTe solar panels cover work accomplished from June 1987 to May 1988. The highest-efficiency devices produced during this period measured 10.6% efficient on a 0.302-cm^2 cell. On 11-7/8 in. by 12 in. panels, the highest output obtained was 5.3 W over 847 cm^2, or 7.0% active-area efficiency. The aperture-area efficiency is presently about 12% lower, or 6.3% efficiency, because of interconnection losses. A 4-ft^2 panel was also produced. Resistivities of less than 100 ohm-cm have been observed consistently in phosphorus- or copper-doped CdTe. Surface analysis is presented for various CdTe treatments. Devices were characterized and analyzed using electron-beam-induced current, capacitance, spectral response, and I-V curves at various temperatures. A model for junction transport is presented. An encapsulation system is described, and lifetime test results are presented. 13 refs., 26 figs.

26448 (SNC–C-118) **Study on the generation of design data for biomass liquefaction pilot plants.** Cooke, N.E.; Moffat, J.M.; Robillard, L.A. SNC Group, Montreal, PQ (Canada). 1981. vp. (CE–02497). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

SNC has designed a laboratory apparatus to permit the continuous production of proto-oil from one gallon per hour of 30% wood slurry, by the thermocatalytic process. The cost of this unit is estimated at $30,000, and it was intended to be built and operated to allow generation of the minimal process data required to permit the design of an envisaged 2 bbl/day wood to proto-oil pilot plant. However, because recently generated estimates indicate excessively high production costs for proto-oil and its derivatives, it is now advisable to interrupt work prior to construction and redirect resources elsewhere. Recommendations are made to this effect. Visits have been made to the Albany and Lawrence Berkeley Laboratories wood liquefaction facilities. The possible applications of wood oils are listed. 8 refs., 5 figs.

1406 Photovoltaic Power Systems

26449 (SAND–88-7043) **A study of the economic impact of operating photovoltaic systems in the electric utility grid.** Rahman, S. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Energy Systems Research Lab. Mar 1989. 104p. DOE Contract AC04-76DP00789. Order Number DE89011322/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The purpose of this study was to determine parameters that impact the value of photovoltaics to the electric utility. For this investigation, we therefore chose the high-, medium-, and low-load days in winter (January) and summer (July) with daily peak loads varying from 5838 MW to 9712 MW. These six days are studied for reference, no photovoltaics, and high, median, low, and intermittent solar cases. Results from these thirty case studies are presented in this report. We chose the load profile of a Southeastern utility and the photovoltaic output data from solar test facilities in Virginia and North Carolina. The capital cost of photovoltaics has not been considered. To incorporate short-term variations, we used 10-minute resolution data for both load and photovoltaic output. The performance analysis shows that, although the total production (fuel and variable O and M) cost savings are higher for high solar days, the increase is not proportional to the amount of photovoltaic energy output. The highest photovoltaic energy value comes when combustion turbine generation is displaced, since this generation is the most expensive. This indicates that a smaller photovoltaic plant size should have been selected originally; however, the scope of the contract did not allow investigating multiple plant sizes. 4 refs., 12 figs., 11 tabs.

26450 A photovoltaic voltage regulation impact investigation technique. Garrett, D.L. (Southern Electric International, Birmingham, AL (US)); Jeter, S.M. *IEEE Transactions on Energy Conversion (USA)*, 4(1): 47-53 (Mar 1989).

With changing weather patterns or clouds moving over a given utility service area, the power generated by any photovoltaic (PV) systems in that service area will vary tremendously. Depending on the percent penetration of these PV systems on a distribution feeder, these variations in the PV systems' performance may cause undesirable voltage fluctuations along the feeder and also may impact the operation of the voltage regulating equipment on the distribution feeder. A model was developed to simulate these variations in PV system outputs due to moving clouds and to predict the distribution system voltage performance and the effect on the distribution system voltage regulating equipment.

1407 Solar Thermal Power Systems

26451 (DTH-LV-MEDD–194) **Projecting of larger solar collector systems. Creation of systems and diagrams for calculating losses and yields.** Energiministeriets Solvarmeforskningsprogram. Rapport, 48. Mikkelsen, S.E. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Nov 1988. 242p. (In Danish). Order Number DE88757292/JAW. Available from NTIS (US Sales Only), PC A11/MF A01.

Energiministeriets Solvarmeforskningsprogram. Rapport, 48.; EFP-82; EFP-86.

Tables and diagrams for determinating the thermal performance of large solar heating systems have been developed. The thermal performance can be found as a function of the heat storage temperature. Different system designs, shadow conditions, earth reflections, tilts of the solar collectors, etc. are taken into consideration. Further, diagrams for dimensioning the pipe systems and for determining the flow distribution in the solar collector array have been developed. The suitability of different system designs and control systems is elucidated. The tables and diagrams are especially suitable in connection with the pilot planning of large solar heating systems, either in combination with other energy sources, in connection with seasonal solar heat storage, in connection with the heating of the return pipe in a district heating plant or in connection with low temperature heat utilization in industry. Furthermore, many of the diagrams are also suitable for large, and smaller, solar heating systems for domestic hot water supply and for solar heating systems for heating swimming pools. (AB) 32 refs.

26452 Economic analysis of solar thermal energy systems. Solar heat technologies: Fundamentals and applications. West, R.E.; Kreith, F. (eds.). 435p. Massachusetts Institute of Technology, Cambridge, MA (1988).

Sunshine may be abundant and free, but converting it into a usable form of energy is expensive. Investment decisions, funding of research and development, and commercial applications all rely on economic analysis. This book reviews the spectrum of economic methods that have been developed from the mid-1970s to the mid-1980s to analyze the feasibility of solar systems and shows how the use of these techniques have influenced federally sponsored research, development, and demonstration programs. There is a strong emphasis on the use of methods and modeling in studying policy alternatives. The book also reviews applications analysis, net energy analysis, and cost requirements for active and passive heating and cooling, for electric-power generation, and for industrial-process heat. The change in the costs of solar systems over time is one indication of program success, and the book includes a useful summary of the cost histories of various solar programs. 34 refs.

26453 (SAND–88-2895) **Dynamic simulation of a molten-salt solar receiver.** Kolb, G.J.; Neary, D.; Ringham, M.R.; Greenlee, T.L. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 90p. DOE Contract AC04-76DP00789. Order Number DE89010556/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A dynamic simulation model of the solar subsystem of a molten-salt-in-tube central receiver power plant was constructed. It consists of 132 ordinary differential equations and is programmed in the System Simulation Language. The model was validated with experimental data obtained at the Central Receiver Test Facility and was shown to accurately predict actual receiver performance. It can be used to perform the following types of studies: (1) optimization of control algorithms for salt-in-tube receiver plants, (2) analysis of system performance during transient conditions, (3) response of the system following component failures, and (4) optimization of power production. The model is user friendly, includes several real-time graphic displays, and runs real time on a personal computer. 15 refs., 36 figs.

26454 (SAND–89-7026) **Radiometric measurement of temperature distributions in solar cavity receivers.** Thacher, E.F.; Giannola, P.S. Clarkson Univ., Potsdam, NY (USA). Dept. of Mechanical Engineering; United Technologies Research Center, East Hartford, CT (USA). Mar 1989. 191p. DOE Contract AC04-76DP00789. Order Number DE89011467/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

An engineering tool incorporating a scanning infrared radiometer, an image digitizer, a microcomputer, and the software to drive the system was developed to allow remote mapping of the temperature distribution in solar cavity receivers. Using enclosure analysis, the infrared image processing program extracts the irradiance map from the radiosity map of the cavity to yield an emissive power map. Using the calibration curve of the radiometer and the emissivity of the surface of the cavity, the emissive power map is transformed into a temperature map. The system was tested by comparing its calculated temperatures to temperatures measured by thermocouples at several locations on the surfaces of heated model cavity receivers. The average relative error for the cavities ranged from 4.6%–34.9%, with the relative error on the base usually less than half that on the wall. Some work was also carried out to compensate the detected radiosity field for the system transfer function error of the scanner system. 8 refs., 57 figs., 3 tabs.

1408 Ocean Energy Systems

26455 Gradient layer entrainment correlation for a salt gradient solar pond with storage layer recirculation. Munoz, D.R. (Engineering Dept., Colorado School of Mines, Golden, CO (US)); Zangrando, F., Viskanta, R.; Incropera, F.P. *Journal of Solar Energy Engineering (USA),* 110(4): 248-254 (Nov 1988).

Experiments were performed in a large tank to determine the effects of combined mixing, due to bottom heating and a horizontal recirculation, on the entrainment of salt stratified fluid. Entrainment rate data obtained for large Richardson numbers were used with existing data for smaller Richardson numbers to develop a single term correlation for the range of $10^2 < Ri < 10^4$. The appropriate velocity and length scales for the combined mixing experiments were the convective velocity, the square root of the jet kinematic momentum flux divided by the distance from the discharge diffuser to the interface, and the height of the mixed layer.

1409 Solar Thermal Utilization

Refer also to citation(s) 26655

1410 Solar Collectors and Concentrators

26456 (DTH-LV–87-17) **Solar collector with airglass component - calculations and measurements.** Ingerslev Jensen, K.; Svendsen, S.Aa. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Oct 1987. 46p. (In Danish). Order Number DE88757291/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A full scale solar collector, in which monolithic silica serogel tiles are integrated, has been designed, constructed and tested. The chemical composition of the material is SiO_2, or quartz. According to (Henning, 1981) the material consists of grains of silica molecules with a typical dimension of 4-7 nm. The grains are formed and interconnected by a sol-gel process in methanol. After a super critical drying of the alco-gel the highly porous silica aerogel is formed as monolithic tiles. The typical size of the open pores is 10 - 20 nm. The density of the material used in this work is about 100 kgm^{-3}. The index of refraction is 1.02. The normal solar transmittance for 20 mm thick tiles was measured to 90% with a variation of $\pm 2\%$. The thermal conductivity is about 0.020 $Wm^{-1}K^{-1}$ at room temperature. The material is stable at temperatures up to 750 deg. C and pressures up to 300 kPa, but it is fragile and must be protected against liquid water and other fluids. The trademark of the material is Airglass and it is produced by Airglass AB in Lund, Sweden. The dimensions of the tiles used for this work are 18 cm x 18 cm x 2 cm. Heat transfer in monolithic silica aerogel is due to conduction and infrared radiation. Convection in the very small pores can be ignored. It is obvious that the silica aerogel has a great influence on the heat loss coefficient while the reduction of the maximum efficiency is rather low. There is some difference between the measured and calculated efficiency but this was expected mainly due to the large number of small air gaps between the 60 silica aerogel tiles. Some convection and infrared radiation will take place from the absorber to the cover through these gaps. The efficiency of the silica aerogel collector is clearly improved in comparison with the efficiency of the typical selective collector shown. (AB) 10 refs.

1420 Heat Storage

Refer also to citation(s) 26655

26457 (NEI-DK–146) **Solar heating system with dual heat storage for storing solar heat and accumulated electric power.** Esbensen og Korsgaard Raadgivende Civilingenioerer, Copenhagen (Denmark). Jan 1988. 58p. (In Danish). Order Number DE88757308/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

A prototype for combined heat storage for storing solar heat during the summer months and electric power, for off-peak pricing, during the winter. The installation has dimensions which should ensure complete coverage of space heating and ho water needs in a household which uses 15.000 kWh per annum. The construction and building up of the combined heat storage system is described in considerable detail and illustrated by diagrams. The operation of the system is also explained, and the results of a series of function tests are given. (AB).

15 GEOTHERMAL ENERGY

Refer also to citation(s) 26619

1501 Resource Status and Assessment

26458 (DOE/ID/12742–T1) **Geothermal resource assessment in the Aleutian Islands and Alaska peninsula: Quarterly progress report, January 1–March 30, 1989.** Turner, D.L.; Nye, C.J. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. 1989. 10p. DOE Contract FG07-88ID12742. Order Number DE89010826/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this report the authors have now completed dating work on 20 rock samples. Analytical results for the dated samples are given in the enclosed table. The results are generally in good agreement with observed stratigraphic relationships and provide a well-constrained time framework for the eruptive history of this volcanic area. The argon extraction and potassium analyses are completed and the argon sample is awaiting mass spectrometry. In addition to documenting the eruptive history of Umnak volcanoes, the K-Ar ages will provide a time framework for the chemical evolution of the magmatic system, when combined with the rock chemistry analyses presently in progress at U.C., Santa Cruz. 1 tab.

1502 Geology and Hydrology of Geothermal Systems

Refer also to citation(s) 26458, 27336

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 27336

26459 (LA–11496-OBES) **Selected data fron continental scientific drilling core holes VC-1 and VC-2a, Valles Caldera, New Mexico.** Musgrave, J.A.; Goff, F.; Shevenell, L.; Trujillo, P.E. Jr.; Counce, D.; Luedemann, G.; Garcia, S.; Dennis, B.; Hulen, J.B.; Janik, C.; Tomei, F.A. Los Alamos National Lab., NM (USA). Feb 1989. 72p. DOE Contract W-7405-ENG-36. Order Number DE89010765/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report presents geochemical and isotopic data on rocks and water and wellbore geophysical data from the Continental Scientific Drilling Program core holes VC-1 and VC-2a, Valles Caldera, New Mexico. These core holes were drilled as a portion of a broader program that seeks to answer fundamental questions about magma, water/rock interactions, ore deposits, and volcanology. The data in this report will assist the interpretation of the hydrothermal system in the Jemez Mountains and will stimulate further research in magmatic processes, hydrothermal alteration, ore deposits, hydrology, structural geology, and hydrothermal solution chemistry. 37 refs., 36 figs., 28 tabs.

1508 Geothermal Power Plants

26460 (EGG-M–89092) **Advanced binary geothermal power plants working fluid property determination and heat exchanger design.** Bliem, C.J.; Mines, G.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 8p. DOE Contract AC07-76ID01570. (CONF-890352–5: US Department of Energy research and development for the geothermal marketplace: 7th geothermal program review, San Francisco, CA, US, March 21, 1989). Order Number DE89011144/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The performance of binary geothermal power plants can be improved through the proper choice of a working fluid, and optimization of component designs and operating conditions. This paper reviews the investigations at the Idaho National Engineering Laboratory (INEL) which are examining binary cycle performance improvements for moderate temperature (350 to 400 F) resources with emphasis on how the improvements may be integrated into design of binary cycles. These investigations are examining performance improvements resulting from the supercritical vaporization of mixed hydrocarbon working fluids and achieving countercurrent integral condensation with these fluids, as well as the modification of the turbine inlet state points to achieve supersaturated turbine vapor expansions. For resources where the brine outlet temperature is restricted, the use of turbine exhaust recuperators is examined. The baseline plant used to determine improvements in plant performance (characterized by the increase in the net brine effectiveness, watt-hours per pound of brine) in these studies operates at conditions similar to the 45 MW Heber binary plant. Through the selection of the optimum working fluids and operating conditions, achieving countercurrent integral condensation, and allowing supersaturated vapor expansions in the turbine, the performance of the binary cycle (the net brine effectiveness) can be improved by 25 to 30% relative to the baseline plant. 15 refs., 7 figs.

1509 Geothermal Engineering

Refer also to citation(s) 27336

26461 Fractured geothermal reservoir growth induced by heat extraction. Tester, J.W. (MIT, MA (US)); Murphy, H.D.; Grigsby, C.O.; Potter, R.M.; Robinson, B.A. *SPE (Society of Petroleum Engineers) Reservoir Engineering (USA),* 4(1): 97-104 (Feb 1989).

Field testing of a hydraulically stimulated, hot, dry rock (HDR) geothermal system at the Fenton Hill site in northern New Mexico indicated that significant reservoir growth occurred as energy was extracted. Tracer, microseismic, and geochemical measurements provided the primary quantitative evidence for the increases in accessible reservoir volume and fractured rock surface area that were observed during energy extraction operations that caused substantial thermal drawdown in portions of the reservoir. These temporal increases suggest that augmentation of reservoir heat-production capacity in an HDR system may be possible.

1510 Direct Energy Utilization

26462 (DOE/ID/12693–2) **Geothermal direct use engineering and design guidebook.** Bloomquist, R.G.; Culver, G.; Ellis, P.F.; Higbee, C.; Kindle, C.; Lienau, P.J.; Lunis, B.C.; Rafferty, K.; Stiger, S.; Wright, P.M. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. 402p. DOE Contract FG07-87ID12693;AC07-76ID01570. Order Number DE89010700/JAW. Available from NTIS, PC A18 - OSTI.

The Geothermal Direct Use Engineering and Design Guidebook is designed to be a comprehensive, thoroughly practical reference guide for engineers and designers of direct heat projects. These projects could include the conversion of geothermal energy into space heating cooling of buildings, district heating, greenhouse heating, aquaculture and industrial processing. The Guidebook is directed at understanding the nature of geothermal resources and the exploration of these resources, fluid sampling techniques, drilling, and completion of geothermal wells through well testing, and reservoir evaluation. It presents information useful to engineers on the specification of equipment including well pumps, piping, heat exchangers, space heating equipment, heat pumps and absorption refrigeration. A compilation of current information about greenhouse, aquaculture and industrial applications is included together with a discussion of engineering cost analysis, regulation requirements, and environmental considerations. The purpose of the Guidebook is to provide an integrated view for the development of direct use projects for which there is a very potential in the United States.

1520 Geothermal Data and Theory

Refer also to citation(s) 26461

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

26463 (NEI-DK–137) **Projecting for a wave energy power plant. Stage B. Tentative model and pilot project.** Hoejlund Rasmussen (B.) Raadgivende Civilingenioerer, Copenhagen (Denmark). Jun 1988. 136p. (In Danish). Order Number DE88757300/JAW. Available from NTIS (US Sales Only), PC A07.

Design and feasibility study of a wave energy power plant which could be used in the North Sea. The effects of storm wave forces on the converter and its units were measured in a water tank, and were recorded on video tapes and in table form. Measurements were also effected on the behaviour of cylinder and disc-shaped floats under varying wave forces. Computerized simulation was utilized. Energy production per square meter of water surface was measured and found to exceed expectations by 20%. Three combinations of turbines and generators were investigated. A cost benefit analysis was carried out and it was found that total investment in a wave energy power plant consisting of 4000 units, in the North Sea would cost about 7540 milliard Danish kroner. The annual energy production should reach 870 mio. kWh and annual running time 1175 hours. Taking into account the running costs of 45 mio. Danish kroner per annum, and interest rates and depreciation as 7.5%, the energy price is reckoned at roughly 70% of a Danish krone per kWh. (AB).

17 WIND ENERGY

Refer also to citation(s) 26619

1701 Availability (climatology)

26464 (RISO-M–2749) **Roughness change effects for small and large fetches.** Sempreviva, A.M.; Larsen, S.E.; Mortensen, N.G.; Troen, I. Risoe National Lab., Roskilde (Denmark). Oct 1988. 44p. Order Number DE88757323/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

EFP-81; EFP-84.

Measurements were obtained during a two-year period along four meteorological masts placed from the coastline to 30 km inland at the North Sea coast of Jutland in Denmark (JYLEX). From these data the near neutral cases were selected. The data are organized to show the reduction of wind speed as a function of inland fetch. The results are stratified according to season and are compared with a simple model description of the response of the neutral boundary layer to step changes in surface roughness. (author) 11 tabs., 10 ills., 21 refs.

1703 Regulations

26465 (NEI-DK–152) **Recommendation for an European wind turbine safety standard.** Hjuler Jensen, P.; Hauge Madsen, P.; Winther-Jensen, M.; Machielse, L.; Stam, W.; Einsfeld, V.; Woelfel, E.; Elliot, G.; Wilde, L. de. Risoe National Lab., Roskilde (Denmark). Sep 1988. 23p. Order Number DE88757314/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The objective is to establish an European standard for wind safety which should apply for all member countries of the European Communities. The document contains a list of recommended safety requirements in relation to the system, structure, electrical installations, operation and maintenance of wind turbines. The recommended safety standards cover electricity producing wind turbines connected to electricity grids in both single and cluster applications and with a swept area in excess of 25 square meters and/or a rated power of 10kW. The document should be used in combination with The European Standards for Wind Turbine Loads and other relevant European Standards. Environmental condition, with the emphasis of wind conditions and more extreme climatic conditions, are also considered in relation to safety requirements. (AB).

26466 (PB–89-153183/XAB) **NEN 6096, design regulation for small wind turbines with horizontal axis).** Ottens, H.H.; Machielse, L.A.H. Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam (Netherlands). 1988. 13p. (In Dutch). (NLR-MP–88005-U). Available from NTIS, PC EE02/MF A01.

In 1985, a draft regulation for safety for wind turbines(NEN 6096) was published. Special attention was paid to the structural safety. In 1988, the final version of these regulations will be published. In the final version the results of the project Design criteria for small wind turbines were incorporated. Moreover, the methodology and terminology of the draft design standards for buildings (NEN 6700 series) were adapted.

1706 Wind Energy Engineering

Refer also to citation(s) 26466

26467 (NEI-DK–140) **Parameter study of LM 9.7 m wind turbine blades. Measurement of efficiency curves and breaking proficiency of an LM 9.7 m wind turbine blade mounted on a WM 20 S wind turbine produced by Wind Matic.** Gjerding, J.B. Tripod Wind Data ApS, Farum (Denmark). Aug 1988. 83p. (In Danish). Order Number DE88757302/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Measurements of performance and breaking efficiency of a LM 9.7 m wind turbine blade mounted on a WM 20 S wind turbine produced by the firm Wind Matic in Denmark. Measurements were made, taking account of wind speed and direction, electric power production, the number of rotations, air pressure and temperature with a scanning frequency of 17 Hz, nacelle orientation and using a mean period of one minute. (AB).

26468 (RISO-M–2709) **Wind turbine test Vestas V20, 100 kW.** Schmidt Paulsen, U.; Markkilde Petersen, S.; Voelund, P.; Friis Pedersen, T. Risoe National Lab., Roskilde (Denmark). Dec 1988. 67p. Order Number DE88757322/JAW. Available from NTIS (US Sales Only), PC A04.

The report describes standard measurements performed on a Vestas V20 100 kW Prototype wind turbine. The measurements carried out and reported here comprises the power output, system efficiency, energy production, transmission efficiency, rotor power, rotor efficiency, air-brakes efficiency, structural dynamics, loads at cut-in and braking, rotor torque at stopped condition and yaw errors statistics. (author) 11 tabs., 30 ills., 6 refs.

26469 (RISO-M–2762) **Wind turbine test Wincon 99 XT prototype.** Voelund, P.; Schmidt Paulsen, U.; Markkilde Petersen, S.; Friis Pedersen, T. Risoe National Lab., Roskilde (Denmark). Dec 1988. 80p. Order Number DE88757324/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report describes standard measurements performed on a Wincon 99 XT 108 kW wind turbine. The measurements carried out and reported here comprises the power output, system efficiency, energy production, transmission efficiency, rotor power, rotor efficiency, air-brakes efficiency, structural dynamics, loads at cut-in and braking, rotor torque at stopped condition and yaw error statistics. (author) 10 tabs., 26 ills., 6 refs.

26470 (RISO-M–2763) **Discretization algorithm for profiles with an analytical representation.** Larsen, G.C. Risoe National Lab., Roskilde (Denmark). Jan 1989. 35p. Order Number DE88757325/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The present report deals with a discretization procedure for profile families with an analytical representation. The method faciliate a digital representation with a well-defined absolute error tolerance, and is illustrated by application to NACA 4-digit, NACA 5-digit and Clark Y profiles. The specific models for the above-mentioned profile categories have been made accessible by being implemented into an interactive program package designed for use on a personal computer. The use of the package is described.

20 ELECTRIC POWER ENGINEERING

26471 (NSP–1988) **Nova Scotia Power Corporation. Sixty-eighth annual report, 1987/1988.** Nova Scotia Power Corp., Halifax (Canada). 1988. 32p. (MICROLOG–89-00834). Available from Nova Scotia Power Corporation, Barrington Tower, Scotia Square, PO Box 910,, Halifax, NS, Canada B3J 2W5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual report discusses the financial achievements of the Corporation, as well as achievements in the field of advanced technology. Some of the topics mentioned included: computer-aided-design and drafting, static var compensator, Manager's Intelligent Debt Advisor System, water quality monitoring system, thermal efficiency monitoring system, and protection of the environment. The Corporation is investigating the possibility of exporting power to New England via a high voltage direct current subsea cable. The financial statements as at March 31, 1988 are given. 13 figs., 6 tabs.

26472 (OH/RD–1988) **Ontario Hydro Research Division annual report, 1988.** Floyd, G. Ontario Hydro Research Div., Toronto, ON (Canada). 1988. 61p. (MICROLOG–89-00467). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual report presents information on the research activities of the various sections, including coal, chemical, electrical, mechanical, metallurgical, and operations research, of Ontario Hydro, as well as various divisional projects and services, resources and costs, presentations, and publications. A 75th anniversary insert is also included. The manager and principal staff for each section are listed, with an overview of the year's activities, and short descriptions of the research activities being carried out.

2001 Power Plants and Power Generation

Refer also to citation(s) 26212, 26212, 26227, 26479, 26740, 26741, 26764

26473 (DOE/ET/10815–126) **Magnetohydrodynamics coal-fired flow facility: Quarterly progress report, July–September 1988.** Tennessee Univ., Tullahoma, TN (USA). Space Inst. Apr 1989. 35p. DOE Contract AC02-79ET10815. (UTSI–88-09). Order Number DE89010702/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this Quarterly Technical progress report, UTSI reports on progress in proof-of-concept (POC) testing and development of the components for a magnetohydrodynamic (MHD) steam bottoming plant. The primary activities discussed are results of a 252 hour, coal-fired test in the Department of Energy Coal Fired Flow Facility (CFFF). The performance of the upstream components, which simulate the MHD topping cycle for the generation of test gases with the correct time-temperature history, was significantly more reliable than in previous tests. In the bottoming cycle tests continued on candidate superheater test module (SHTM) tube materials in three different temperature zones. The test achieved all objectives in this area. Difficulties continued in keeping the accumulation of deposits sufficiently blown-off on the high temperature tubes of the first test section and the following cooling section. Particulate loading samples were taken to evaluate the effectiveness of the baghouse and electrostatic precipitator (ESP). Results of varying the flow rate through the ESP to determine the minimum specific collection area (SCA) to meet the New Source Performance Standard (NSPS) particulate emission standards are reported. Reports of on-going studies and analyses are summarized. Results of utilization of advanced diagnostics by both UTSI and MSU are included. Data and analyses from stack gas analysis, water quality, ambient air sampling and terrestrial ecology programs are summarized and future plans are outlined. 14 figs., 1 tab.

26474 (EPRI-GS–6354) **Identification of power plant auxiliary system problems: Final report.** Appiarius, J.C.; Brander, J.A.; Brown, P.G.; Crenshaw, M.L. Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., Schenectady, NY (USA). Apr 1989. 280p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The final report for EPRI project RP2626-1, "Power Plant Auxiliary System Improvements", documents work performed by the General Electric Company on Tasks 1 through 7. The objective of this work was to identify the existing and/or potential areas of improvement for the power plant electric auxiliary system. A survey of industry experience at fossil fueled and hydro generating stations was performed. Information concerning auxiliary system problems was collected for 119 fossil field generating units and 58 hydroelectric stations. The information was reviewed, collated and information related to problems was organized in major categories. The information was presented to utility industry representatives at three workshops. Recommendations for future research projects were identified from the review of the survey information and suggestions of the workshop participants. Work statements for selected future research projects were prepared. 2 refs., 50 figs., 15 tabs.

26475 (OME–8708) **Natural gas as an electricity supply option.** Ontario Ministry of Energy, Toronto (Canada). 1987. 81p. (MICROLOG–88-05563). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In assessing the potential contribution of natural gas to the electricity supply, the opens begins with an overview of Ontario Hydro's bulk electricity system resource plan, demand and supply options, and plans relating to natural gas. It examines economic options for use of natural gas in the Ontario Hydro system and by private power producers in both combined-cycle and co-generation configerations. The long-term availability and cost of natural gas and options for purchase are discussed along with the barriers which exist to the wider use of natural gas in electricity generation, strategic issues which are important in review of the gas option, and policy implications. Information on which the study was based included studies commissioned by the Ontario Ministry of Energy on coal technologies, uncontracted natural gas reserves, and the potential for co-generation; Ontario Hydro demand/supply options and resource studies and interviews with Ontario Hydro staff, the Ontario Ministry of Energy staff, and representatives of the natural gas industry. The information and analysis provided in this study suggest that natural gas may have strategic advantages in the production of electricity which merit close review by the Ontario government, Ontario Hydro, and other Ontario-based gas users. A glossary of technical terms is included. 3 figs., 12 tabs.

2002 Environmental Control Technology

Refer also to citation(s) 26229, 26230, 26253, 26473, 27131, 27157

26476 (PB–89-161772/XAB) **Advanced Utility Simulation Model. Analytical documentation, state-level model (Version 1.0). Final report, September 1980-August 1985.** Stukel, J.J. Illinois Univ., Urbana, IL (USA). Coll. of Engineering. Jan 1989. 578p. Available from NTIS, PC A25/MF A01.

See also PB–89-126569 and PB–89-161780.

This report is one of 11 in a series describing the initial development of the Advanced Utility Simulation Model (AUSM). The AUSM is one of four stationary source emission and control cost forecasting models developed by EPA for the National Acid Precipitation Assessment Program (NAPAP). The AUSM projects air-pollution emissions (SO_2 and NOx), generating technology types and costs of operation, and combinations of fuels and emission control technologies to simultaneously meet electric demand and emission constraints on a least-cost basis for each year through 2010. Thirteen electric-demand regions are simulated, and output is provided for each of the 48 contiguous states. The initial version of AUSM, Version 1.0, was delivered in November 1984 and August 1985. Further development of the AUSM between 1985 and 1988 has resulted in the development of Versions 2.0 and 3.0. Reports describing these revisions to the initial Version 1.0 of AUSM are also part of the series.

26477 (PB–89-161780/XAB) **Advanced Utility Simulation Model. Description of modifications to the state level model (Version 3.0). Final report, March 1986-June 1988.** Capone, R.L.; Lassinger, R.; Peterson, C.; May, E. Science Applications International Corp., McLean, VA (USA). Jan 1989. 93p. Available from NTIS, PC A05/MF A01.

See also PB–89-161772.

This report documents modifications to the state level model portion of the Advanced Utility Simulation Model (AUSM), one of four stationary source emission and control cost forecasting models developed for the National Acid Precipitation Assessment Program (NAPAP). The AUSM model, originally developed in two principal parts (the national loop and the state level model), projects air pollution control and electric rates by consumer category by state and year. The state-level model modifications followed testing and review that identified four types of required revisions: (1) correction of coding errors that caused syntactical or logical problems; (2) addition of new knowledge about electric-utility operations, generating and emissions-control equipment, ways in which users wish to run the model, and user information needs; (3) modification of components to permit calibration of AUSM to more accurately simulate the historical years, 1980-1985; and (4) incorporation of changes in external factors such as new tax requirements and financing trends. Only Revisions 2, 3, and 4 are included in the volume. Revision 1 modifications are documented in the source code by comment.

2003 Power Transmission and Distribution

Refer also to citation(s) 26883

26478 (EFI-TR–3521) **Superconducting materials in the electric power engineering.** Runde, M.; Gamlesaeter, K.; Skarpnes, J.O.; Stryken, E. Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway). Aug 1988. 155p. (In Norwegian). Order Number DE88757296/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

The discovery of new materials which are superconducting at temperatures above the boiling point of nitrogen (-196^{0C}), has led to a renewed interest in application of superconductors in electric power engineering. The superconductors may increase the efficiency, e.g. in generators, motors, transmission cables and transformers. The development of the new superconductors has not yet resulted in materials with mechanical, electrical and chemical properties which are sufficiently good for utilization in electric power engineering components. If the problems of the above mentioned material properties are solved in the future, superconducting electrical power components will compete with conventional components, but probably only for high power applications. 81 refs., 52 figs., 9 tabs.

26479 (EPRI-EL–6275) **Fault current limiters: Basic concepts and associated technologies: Final report.** Dollinger, R.; Shea, J.J.; Nikolich, M.; Dettman, D.R.; Bernard, M.J.; Wallmann, B. Electric Power Research Inst., Palo Alto, CA (USA); State Univ. of New York, Buffalo, NY (USA). Apr 1989. 108p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A summary review of Fault Current Limiters (FCL) by Basic Concepts and Their Associated Technologies is presented from both a historical perspective as well as for re-application to future ideas. Design of current limiters using new technology is facilitated by having a target of technical design parameters for the System (e.g., voltage, current, prospective fault current and current limit of its most sensitive component), FCL Insertion Loss when in its "Low Impedance" Mode (e.g., resistance and inductance), FCL "High Impedance" when in its Limiting mode (e.g., resistance, inductance, power rating and energy consumption) and lastly its transient Impedance Transition (e.g., voltage gain, impedance gain, power gain and energy gain). The example presented uses a 145 kV, 30 system with a maximum load current of 2000 A. The most sensitive element was considered to be earlier style 40 kA breakers. The numbers of this example are not used as hard barriers to limit possible performance of a FCL scheme, but are given merely to gain orientation. 8 refs., 6 figs., 5 tabs.

26480 (PB–89-153464/XAB) **Insulator flashover in SF6 gas.** Verhaart, H.F.A.; Verhage, A.J.L. Keuring van Electrotechnische Materialen N.V., Arnhem (Netherlands). 1988. 54p. Available from NTIS, PC EE04/MF A01.

Abstract in Japanese. Pub. in Kema Scientific and Technical Reports, Vol. 6, No. 9, 179-228(1988).

Flashover along solid insulators in SF6 was studied experimentally. The breakdown voltage was measured under different experimental conditions; the parameters varied were: the voltage source (AC, DC, and lightning impulse), gas pressure, electrode distance, charge condition of the insulator surface (positively charged, negatively charged or uncharged), insulator material (epoxy resin or Teflon-PTFE) and insulator shape (cylindrical or conical). Special attention was paid to the deposition, measurement and decay of surface charges on insulators. The modification of the applied electric field by surface charges was computed. Experiments with an image-converter camera showed that photons play an important role in the flash-over mechanism. Measurements of the quantum yield of photo-emission can contribute to the formation of avalanches. A new model for time-dependent growth of an avalanche near an insulator is presented. The model takes into account field disturbances caused by surface charges. Comparison between this model and measured avalanche currents yielded values for a photo-emission coefficient. The surface damage to an insulator after flashover was also investigated.

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 26529

26481 (INIS-mf–11936) **Systems with artificial intelligence in nuclear power plant operation. Some ideas on the current status and potentials of artificial intelligence.** Bastl, W.; Felkel, L. Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.). [1989]. 53p. (In German). Order Number DE89764516/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The authors first summarize some developments made by GRS teams which can be regarded as the precursors of systems with artificial intelligence, and explain the basic characteristics of artificial intelligence, referring in particular to possible applications in nuclear engineering. The systems described are arranged in four groups according to applicability as follows: plant diagnosis and failure analysis, information systems and operating systems, control systems, assessment and decision aids. The working principle of the systems is explained by some examples giving details of the database and the interference processes.

26482 (INIS-SU–77/A, pp. 41-44) **Trends in developing studies on nuclear data.** Kuz'minov, B.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Problems of collection and evaluation of nuclear data used in NPP design are discussed. The main results of fundamental studies, permitting to obtain data satisfying practical needs of nuclear power engineering according to their reliability are considered. It is pointed out that the measurement of nuclear reaction constants is the most expensive and time-consisting activity in nuclear data collection. The development of investigations takes place via creation of more powerful pulsed neutron sources, improvement of time-of-flight methods, design of fast-response and multidetector systems, realization of correlation measurements.

26483 (NUREG–1275-Vol.4) **Operating experience feedback report: Technical specifications: Commercial power reactors.** O'Reilly, P.D.; Plumlee, G.L. III. Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Impell Corp., Fort Worth, TX (USA). Mar 1989. 109p. Available from NTIS, PC A06/MF A01 - GPO - OSTI.

This report documents a trends and patterns analysis of technical specification (TS)-related licensee event reports (LERs) conducted by the Nuclear Regulatory Commission's (NRC's) Office for Analysis and Evaluation of Operational Data (AEOD). The objectives of this analysis were (1) to identify and catalog technical specification-related LERs, (2) to categorize and evaluate the events reported in these a LERs, (3) to identify any issues arising from the evaluation which appear to have generic safety significance, or which relate to the on-going Technical Specification Improvement Program, and (4) to trend the results obtained from the analysis of the data obtained in (1) through (3). 9 refs., 9 figs., 22 tabs.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

Refer also to citation(s) 26365, 26498, 26542, 26543, 26547, 26548, 26549, 26551, 26552, 26556, 26568, 26569, 26570, 26572, 26573, 26584, 26585, 26587, 26588, 26589, 26590, 26593, 26749, 26753, 26849

26484 (CONF-890555–4) **A parametric analysis of decay ratio calculations in a boiling water reactor model.** Blakeman, E.D.; March-Leuba, J. Oak Ridge National Lab., TN (USA). 1989. 10p. DOE Contract AC05-84OR21400. From 7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989. Order Number DE89008717/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The results of an investigation of the effects of several parameters on the reactivity instability of a Boiling Water Reactor (BWR) calculational model are summarized. Calculations were performed for a typical BWR operated at low flow conditions, where reactivity instabilities are more likely to occur. The parameters investigated include the axial power shape (characterized by two separate parameters), the core pressure, and operating flow. All calculations were performed using the LAPUR code which was developed at the Oak Ridge National Laboratory for the dynamic modeling of large BWR's. 4 refs., 8 figs.

26485 (EPRI-NP–6333) **The influence of fuel-cycle duration on nuclear unit performance: An update: Final report.** Koppe, R.H.; Olson, E.A.J. Electric Power Research Inst., Palo Alto, CA (USA); Stoller (S.M.) Corp., Boulder, CO (USA). Apr 1989. 93p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the results of a project conducted by the S.M. Stoller Corporation for EPRI. The purpose of the project was to update the historical performance experience presented in EPRI Report NP-5042, "The Influence of Fuel Cycle Duration on Nuclear Unit Performance." Since that report was published, there has been an additional 2-1/2 years of data collected for all the units. Much of this new experience has occurred at units operating with long fuel cycles. In addition to the investigation of the performance data, a survey of utility personnel was conducted to determine their experience with longer fuel cycle operations. Utility corners and future plans in this regard and the problems that have occurred as a result of a change in fuel cycle length were discussed. Based on this information, the conclusions of EPRI Report NP-5042 were re-examined. It was determined that units which have increased the fuel cycle duration have, on average, improved their performance. For the average unit, this improvement has historically been on the order of 3 to 7 percent. The performance improvement at better performing units is less and therefore the incentive for these units to make this change is diminished. 2 refs., 20 figs., 26 tabs.

26486 (NUREG–1346) **Technical Specifications, South Texas Project, Unit Nos. 1 and 2 (Docket Nos. 50-498 and 50-499): Appendix "A" to License Nos. NPF-76 and NPF-80.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Mar 1989. 449p. Available from NTIS, PC A19/MF A01 - GPO - OSTI.

The South Texas Project, Unit Nos. 1 and 2, Technical Specifications were prepared by the US Nuclear Regulatory Commission to set forth the limits, operating conditions, and other requirements applicable to a nuclear reactor facility as set forth in Section 50.36 of 10 CFR Part 50 for the protection of the health and safety of the public.

26487 (NUREG/CR–3950-Vol.5) **Fuel performance: Annual report for 1987.** Bailey, W.J.; Wu, S. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 150p. DOE Contract AC06-76RL01830. (PNL–5210-Vol.5). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

This annual report, the tenth in a series, provides a brief description of fuel performance during 1987 in commercial nuclear power plants and an indication of trends. Brief summaries of fuel design changes, fuel surveillance programs, fuel operating experience, fuel problems, high-burnup fuel experience, and items of general significance are provided. References to more detailed information and related US Nuclear Regulator Commission evaluations are included. 384 refs., 13 figs., 33 tabs.

26488 (NUREG/CR–4219-Vol.5-No.2) **Heavy-section steel technology program: Semiannual progress report for April–September 1988.** Corwin, W.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Mar 1989. 86p. DOE Contract AC05-84OR21400. (ORNL/TM–9593-Vol.5-No.2). Available from NTIS, PC A05/MF A01 - GPO - OSTI.

The Heavy-Section Steel Technology (HSST) Program is conducted for the Nuclear Regulatory Commission (NRC). The studies relate to all areas of the technology of materials fabricated into thick-section, primary-coolant containment systems of light-water-cooled nuclear power reactors. The focus is on the behavior and structural integrity of steel pressure vessels containing cracklike flaws. During this period, advances were made in the coordinated effort to develop the dynamic materials fracture data and the analytical tools required to construct improved fracture models for reactor pressure vessel (RPV) steels. Analytical efforts included examination of alternative parameters governing dynamic fracture, their corresponding constitutive models and computational implementation, as well as constraint and tunneling effects on crack-arrest calculations. Two areas of NRC topical support were continued: (1) the evaluation of enhanced low-temperature, low-flux irradiation embrittlement on the integrity of RPV supports; and (2) an overall assessment of low-upper-shelf (LUS) welds in RPVs with special emphasis on the reevaluation of the J-integral in assessing large amounts of crack extension. Crack-arrest and other fracture characterization data were obtained for clad-plate and wide-plate series 2 test materials. 133 refs., 11 figs., 6 tabs.

26489 (NUREG/CR–5283) **Closeout of IE Bulletin 79-03: Longitudinal weld defects in ASME SA-312 Type 304 stainless steel pipe spools manufactured by Youngstown Welding and Engineering Co.** Foley, W.J.; Dean, R.S.; Hennick, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA). Apr 1989. 26p. (PARAMETER/IE–174). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

Documentation is provided in this report for the closeout of IE Bulletin 79-03, on the subject of fusion welded austenitic stainless steel pipe (without filler metal) manufactured by the Youngstown Welding and Engineering Company. Only pipe used or planned for use in safety-related systems is considered. The bulletin is closed out on the basis of definite criteria for all of the 121 facilities for which actions were required. This bulletin was issued by the NRC on March 12, 1979, to require certain actions by all holders of operating licenses and construction permits for power reactors. The NRC's concern was based on the discoveries of faulty longitudinal welds at Palo Verde and San Onofre. The investigations for Bulletin 79-03 led to the finding that volumetric examination of the fusion welds per the ASME Code requirements did not assure detection of centerline lack of penetration (CLP). Therefore, the problem of faulty welds applied to all manufacturers of SA-312/A-312 Type 300 Series welded steel pipe. Bulletin 79-03A was issued on April 4, 1980, to supersede the required actions of Bulletin 79-03, and to collect information on all of the subject pipe and fittings in safety-related systems. Refer to NUREG/CR-5284 for the companion closeout report on IE Bulletin 79-03A, "Longitudinal weld defects in ASME SA-312 Type 304 stainless steel pipe." Background information is provided in the introduction and Appendix A of this report as well as NUREG/CR-5284.

26490 (ORNL/tr–89/9) **Boiling water reactor.** Beese, G.; Harand, E.; Loehr, E.; Preusche, G.; Voigt, O. Oak Ridge National Lab., TN (USA). 26 Mar 1981. 11p. Translation of German Patent 2,932,736, August 13, 1979. DOE Contract AC05-84OR21400. Order Number DE89010222/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The invention concerns a boiling water reactor having a reactor core in a reactor pressure vessel, which is connected to a steam converter to form a coolant loop, whereby control rods containing a neutron-absorbing material can be moved into the reactor core for the purpose of controlling the power and shutting off the chain reaction. The invention has set the goal of designing the power control of such a reactor such that the neutron balance is affected as little as possible, so that the boiling reactor can also be operated at low enrichment or, more generally speaking, at a relatively low power density. This requirement is especially important in boiling water reactors having low power, such as those that can be used in developing countries, for example.

26491 (ORNL/tr–89/17) **Nuclear fuel assembly having several vertically arranged fuel rods, a small number of which are absorber rods containing burnable poison.** Fredin, B.; Nylund, O.; Tiren, I. Oak Ridge National Lab., TN (USA). 16 Jan 1975. 13p. Translation of German patent application 2,430,492, June 25, 1974. DOE Contract AC05-84OR21400. Order Number DE89010221/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present invention concerns a nuclear fuel assembly having several vertically arranged fuel rods, a small number of which are absorber rods containing a burnable poison in the form of Gd_2O_3 and a larger number of which are poison-free fuel rods, whereby each absorber rod contains primarily several fuel bodies arranged axially and immediately one after the other in a capsule tube, some of which [bodies] are poison-free and some of which are poison-containing, each absorber rod has several zone sections provided for each absorber zone in the fuel assemblies [and] arranged axially one after the other, and the average poison quantity per volume

unit is different in the individual zone sections. In the case of the absorber rods of the nuclear fuel assembly the burnable poison is distributed in a vertical direction so that the absorption capacity is adjusted as a function of the height of the curve of the excess reactivity variation in the axial direction, as shown in Fig. 4 for example, where this value is designated by Δk.

26492 (PNL–6717) **Extended-burnup LWR [light-water reactor] fuel: The amount, characteristics, and potential effects on interim storage.** Bailey, W.J. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 69p. DOE Contract AC06-76RL01830. Order Number DE89009715/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The results of a study on extended-burnup, light-water reactor (LWR) spent fuel are described in this report. The study was performed by Pacific Northwest Laboratory for the US Department of Energy (DOE). The purpose of the study was to collect and evaluate information on the status of in-reactor performance and integrity of extended-burnup LWR fuel and initiate the investigation of the effects of extending fuel burnup on the subsequent handling, interim storage, and other operations (e.g., rod consolidation and shipping) associated with the back end of the fuel cycle. The results of this study will aid DOE and the nuclear industry in assessing the effects on waste management of extending the useful in-reactor life of nuclear fuel. The experience base with extended-burnup fuel is now substantial and projections for future use of extended-burnup fuel in domestic LWRs are positive. The basic performance and integrity of the fuel in the reactor has not been compromised by extending the burnup, and the potential limitations for further extending the burnup are not severe. 104 refs., 15 tabs.

26493 (SAND–88-7095) **Cost savings from extended life nuclear plants.** Forest, L.R. Jr.; Deutsch, T.R.; Schenler, W.W. Sandia National Labs., Albuquerque, NM (USA); Data Resources, Inc., Washington, DC (USA); Energy and Resource Consultants, Inc., Washington, DC (USA). Sep 1988. 50p. DOE Contract AC04-76DP00789. Order Number DE89009004/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study assesses the costs and benefits of nuclear power plant life extension (NUPLEX) for the overall US under widely varying economic assumptions and compares these with alternative new coal- fired plants (NEWCOAL). It is found that NUPLEX saves future electricity consumers more than 3 cents/-kwh compared with NEWCOAL. The NUPLEX costs and benefits for existing individual US nuclear power plants under base-line, or most likely, assumptions are assessed to determine the effects of the basic plant design and plant age. While benefits vary widely, virtually all units would have a positive benefit from NUPLEX. The study also presents a cost-benefit analysis of the nuclear industry's planned advanced light water reactor (ALWR). It is concluded that ALWR offers electrical power at a substantially lower cost than NEWCOAL. 9 refs., 6 figs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

Refer also to citation(s) 26365, 26485, 26487, 26488, 26489, 26492, 26493, 26539, 26542, 26543, 26547, 26548, 26550, 26551, 26552, 26556, 26569, 26570, 26571, 26572, 26573, 26575, 26582, 26583, 26585, 26587, 26588, 26589, 26593, 26595, 26736, 26749, 26849, 26969

26494 (EPRI-NP–6232-M) **PWR pilot plant life extension study at Surry unit 1: phase 2: Final report.** Owrutsky, S.L. Electric Power Research Inst., Palo Alto, CA (USA); Virginia Electric and Power Co., Richmond, VA (USA); Westinghouse Electric Corp., Monroeville, PA (USA); Virginia Polytechnic Inst., Blacksburg, VA (USA); Stone and Webster Engineering Corp., Boston, MA (USA); Grove Engineering, Inc., Rockville, MD (USA). Mar 1989. 95p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Phase II of the Surry PWR Pilot Plant Life Extension program encompassed the following principal objectives: (1) determine the impact of components that are not critical to plant life extension; (2) develop a methodology to assess life extension effects based on a system performance evaluation that goes beyond single component concerns to address design and interface issues; (3) implement the life extension recommendations identified during Phase I of the Program; and (4) review the seven "potentially critical components" identified, but not evaluated during the Phase I term. The first objective was addressed by developing and implementing a systematic component evaluation approach that emphasized long-term maintenance strategies. The approach developed to address the second objective is called the System Life Cycle Evaluation Methodology. It utilizes reliability and failure analysis techniques to determine their usefulness in life extension programs. The third objective encompassed a broad group of activities, focusing on research and development; test, inspection, and monitoring; engineering and analysis; and data storage and retrieval system upgrades. 24 refs., 10 figs., 7 tabs.

26495 (EPRI-NP–6285-M) **Evaluation of fuel performance at Oconee unit 2: Final report.** Mayer, J.T.; Pyecha, T.D.; Willse, J.T.; Papazoglou, T.P. Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div. Mar 1989. 73p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Twelve failed and non-failed fuel rods from a particular batch were non-destructively examined to determine the causes of failure. The early-life rod failures in the batch had shown a location preference within the assembly lattice: either adjacent to the center instrument tube or in the assembly corner region. The assemblies with rod failures near the instrument tube had operated at relatively high power levels during their first cycle, which appeared to be a contributing factor to the failure mode. The examination, conducted at Duke Power Company's Oconee Nuclear Station, included visual and eddy-current examinations, as well as rod diameter and oxide thickness measurements. The two corner-region rod failures appeared to be due to mechanical damage. The failed rods near the instrument tube had multiple through-wall defects, all of which were concentrated in two relatively narrow axial regions. The defects in the lower region appeared to be secondary. Those in the upper region were in the area of high power and highest cladding temperature, and were oriented toward the instrument tube. Eddy-current indications of ID-initiated part-wall defects were found in non-failed sister rods in the same upper region, indicating that an internal factor may have contributed to the failures. Although some of the upper defects may have been due to secondary hydriding, it is believed that the upper region was the location of the initial failure sites. The appearance of thicker-than-normal crud/oxide deposits in the upper region indicated that external factors may have also contributed to the failure mode. 4 tabs.

26496 (EPRI-NP–6299) **Ultrasonic examination of cast stainless steel.** Jeong, P.; Ammirato, F. Electric Power Research Inst., Palo Alto, CA (USA); Jones (J.A.) Applied Research Co., Charlotte, NC (USA). Apr 1989. 94p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Cast stainless steel (CSS), used extensively for nuclear power plant components, has a range of complex grain structures that makes conventional ultrasonic examination difficult. The high attenuation and scattering caused by coarse grains hamper defect detection, and wave velocity variations and beam skewing caused by highly ordered grains also hinder defect location. Studies were conducted to measure the effects of grain structures on ultrasonic wave propagation, and a program to produce and characterize numerous cracked samples was completed. A parametric analysis of wave velocity, slowness, and wave surfaces was performed to predict wave behaviors within anticipated anisotropic media. In addition, an ultrasonic ray tracing program was developed to visualize anisotropic beam distortion within the CSS structure so that signal arrival time can be measured accurately. Signal processing approaches were evaluated for their effectiveness in improving nondestructive evaluation (NDE) of CSS components and were successfully applied in two field examinations. Field inspections were conducted to validate improved examination and data treatment techniques. Crack detection (CD) and false call (FC) statistics were obtained from measurements made by nine teams (five manual and four automated ultrasonic testing teams) using intentionally cracked CSS specimens. 20 refs., 58 figs., 4 tabs.

26497 (EUR–11699) **Cost/benefit analyses of reactor safety systems.** Commission of the European Communities, Luxembourg (Luxembourg). 1988. 120p. Available from NTIS (US Sales Only), PC A06/MF A01.

The study presents a methodology for quantitative assessment of the benefit yielded by the various engineered safety systems of a nuclear reactor containment from the standpoint of their capacity to protect the environment compared to their construction costs. The benefit is derived from an estimate of the possible damage from which the environment is protected, taking account of the probabilities of occurrence of malfunctions and accidents. For demonstration purposes, the methodology was applied to a 1 300-MWe PWR nuclear power station. The accident sequence considered was that of a major loss-of-coolant accident as investigated in detail in the German risk study. After determination of the benefits and cost/benefit ratio for the power plant and the containment systems as designed, the performance characteristics of three subsystems, the leakoff system, annulus exhaust air handling system and spray system, were varied. For this purpose, the parameters which describe these systems in the activity release programme were altered. The costs were simultaneously altered in order to take account of the performance divergences. By varying the performance of the individual sub-systems an optimization in design of these systems can be arrived at.

26498 (EUR–11807) **Preparatory studies for modelling steam condensation on soluble aerosols.** Dunbar, I.H. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 47p. Available from NTIS (US Sales Only), PC A03/MF A01.

Of the fission products which would be released from the core of an LWR in the event of a severe accident, only the noble gases and possibly some of the iodine (depending on chemical form) are likely not to be in the form of aerosols when they reach the containment building atmosphere. Therefore in order to predict the extent of fission product retention on containment building internal structures, one needs to have a good understanding of aerosol deposition processes and of the factors which affect them. Following a severe accident in an LWR, a major component of the containment atmosphere will be steam. If the thermodynamic conditions allow condensation of this steam, this condensation is most likely to occur on the aerosol particles. A major component of the aerosol formed during the in-vessel release following a severe reactor accident will be fission product caesium. It is believed that much of this will enter the containment in the form of the hydroxide which has a great affinity for water, so particle growth due to steam condensation is likely to be a very important mechanism for retaining radioactive caesium within the containment builing. The author provides a systematic review of the basic chemical and physical issues which must be addressed if the phenomena are to be modelled accurately, and gives recommendations on how computer models of condensation onto soluble aerosols should be constructed. He proposes also to perform a systematic review of the existing literature and to perform small-scale thermodynamic experiments wherever important gaps in the data base are discovered.

26499 (FRCEA-TH–181) **Qualification of neutronic properties of undermoderated light water reactors.** Cathalau, S. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. des Reacteurs a Eau; Electricite de France, 92 - Clamart (France); Paris-11 Univ., 91 - Orsay (France). Jun 1988. 207p. (In French). Order Number DE89764016/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

The purpose of this thesis is to qualify the APOLLO calculus of light water under moderated reactors (RSM) fundamental parameters starting from results of ERASME experiences. The first part presents the RSM physics and the particularities of neutronic spectrum. The uncertainties on fundamental parameters are evaluated and the necessity of fundamental qualification basis is demonstrated. The second part is consecrated at ERASME experiences and at the interpretation of results given by the APOLLO code. Our interpretation has shown that the data base CEA-86 associated with the calculation procedures are qualified in all the neutron energy range of RSM. In other part, the uncertainties on fundamental parameters are reduced by a factor 4 owing to ERASME experiences. Now, the APOLLO code associated with the CEA-86 procedure, gives the neutronic parameters of RSM with an error compatible with the project calculations.

26500 (KFKI–1988-48/G) **Analysis of consequences of steam generator collector rupture. Computer code analysis and interpretation of PMK-NVH test results.** Szabados, L.; Ezsoel, Gy.; Perneczky, L.; Csom, V. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Sep 1988. 108p. (In Hungarian). Order Number DE89610853/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The report deals with the experimental investigation of the steam generator collector rupture. Measurement was performed on the PMK-NVH facility. Results of the RELAP4/MOD6 code calculations are also included and a comparison is given between measurement and calculation. (author) 2 refs.; 53 figs.; 2 tabs.

26501 (KFKI–1988-66/G) **Diagnostics of core barrel motion based on the fluctuations of the out-of-core ionization chambers signals. The description of CBM program.** Krinizs, K. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1988. 36p. (In Hungarian). Order Number DE89610826/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report describes the theoretical basis, algorithm and operation of the computer program CBM. The aim of the program is to detect possible motions of the reactor core barrel of a nuclear power plant. For the diagnosis of core motions the 'SPEC-DEC' algorithm developed by Dragt-Tuerken is applied. Fluctuations are detected based on neutron absorption measurements using ionization chambers. Running the CBM code the arrangement of the detectors is given, core motions are determined and displayed in the form of linear graphs or in the flow-chart of the reactor. (author) 4 figs.

26502 (KFKI–1988-68/G) **Thermohydraulic calculations of the WWER-1000 type reactor on core level.** Biro, E.; Maroti, L.; Trosztel, I. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Dec 1988. 28p. (In Hungarian). Order Number DE89610856/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The paper describes the improved versions of the COBRA and COCONT codes. The new versions make possible the thermohydraulic calculation of the whole WWER-1000 type reactor core. The developed codes are modular subroutines of the KARATE program system and they can be used for the calculation of any symmetric part of the entire core. The output of the codes serves as boundary condition for the calculation level of fuel assembly. Finally, the report gives a proposal for further investigations. (author) 8 refs.

26503 (KFKI–1988-69/G) **Joining of code COBRA to the PERF-type boundary conditions.** Maroti, L.; Gyenes, Gy.; Trosztel, I. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Dec 1988. 43p. (In Hungarian). Order Number DE89610857/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The subchannel analysis method for the thermohydraulic investigation of fuel element clusters of nuclear reactor cores is based on the supposition that the boundaries of the investigated space in the radial direction is either closed or the gradients of the parameters are equal to zero. When such a subchannel analysis is applied for the investigation of WWER-1000 type fuel element clusters, it should be able to accept radial boundary conditions coming from the global calculation of the whole reactor core. The paper gives a detailed description of the improvement of COBRA and COCONT subchannel codes for the acceptance of radial boundary conditions. (author) 11 refs.; 6 figs.

26504 (NUREG–1359) **Technical Specifications, Vogtle Electric Generating Plant, Unit Nos. 1 and 2 (Docket Nos. 50-424 and 50-425): Appendix "A" to License Nos. NPF-68 and NPF-81.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Mar 1989. 472p. Available from NTIS, PC A20/MF A01 - GPO - OSTI.

The Vogtle Electric Generating Plant, Unit Nos. 1 and 2, Technical Specifications were prepared by the US Nuclear Regulatory Commission to set forth the limits, operating conditions, and other requirements applicable to a nuclear facility as set forth in Section

50.36 of 10 CFR 50 for the protection of the health and safety of the public.

26505 (NUREG/CR–4929) **The effects of variable amplitude loading on A 533-B steel in high-temperature air and reactor water environments.** Cullen, W.H.; Broek, D. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA); FractuREsearch, Inc., Galena, OH (USA). Apr 1989. 104p. (MEA–2213). Available from NTIS, PC A06/MF A01 - GPO - OSTI.

This report describes the efforts to develop an analytical model for the prediction of fatigue crack growth under service-simulated loading typical of power reactor loadings. Experimentally, the program has involved development of a data base of constant amplitude crack growth rate data and a data base of crack extension data for tests conducted with simple overloads and underloads. The final experimental phase was to conduct a series of service simulation tests using the spectrum proposed by the International Cyclic Crack Growth Rate Group. In concert with this experimental work, an analytical model was developed, incorporating capabilities for modeling the load acceleration and retardation effects which were experimentally observed. The development stages of this model are described. The results of the application of this model to the service simulation tests are extremely encouraging. Suggestions to assist in the continued improvement and verification of the model are presented. 30 refs., 41 figs., 13 tabs.

26506 (ORNL/tr–89/13) **Boiling reactor.** Lindner, J.; Nylund, O. Oak Ridge National Lab., TN (USA). 1989. 13p. Translation of German Patent Application 28 19 928, November 23, 1978. DOE Contract AC05-84OR21400. Order Number DE89010220/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The invention concerns a boiling reactor. It is known that a nuclear reactor that operates according to the counterflow principle can be designed such that a first feedwater flow is fed directly to the lower end of the reactor core, whereas a second feedwater flow is first warmed up somewhat by flowing down through the core without direct contact with the fuel rods before it joins the first feedwater flow mentioned above. The reactor described is a pressurized water reactor of specialized design, which is fed with cooling water at supercritical pressure, whereby the supplied coolant flow is equal to the discharged coolant flow. The invention is based on the problem of developing a boiling reactor of the type mentioned above, which operates according to the counterflow principle. 3 figs.

2103 Power Reactors, Non-breeding, Graphite Moderated

Refer also to citation(s) 26580, 26591, 26592, 26733

26507 (EUR–11635) **Market potential of HTR modular reactors as a heat source for high - temperature processes in the Federal Rupublic of Germany.** Commission of the European Communities, Luxembourg (Luxembourg). 1988. 72p. Available from NTIS (US Sales Only), PC A04/MF A01.

The HTR is the only reactor system which can provide process heat in a wide temperature range up to 950^{0}C. The HTR module is designed as an unsophisticated, safe and universal heat source with a large field of applications. The following applications have been considered: the steam reforming of natural gas and coal conversion processes for the production of methanol, hydrogen and SNG. They are investigated in many different modifications and nuclear and autothermal processes are compared. Other applications of nuclear process heat in the chemical and petrochemical industry seem to be appropriate and promising, but could not be analysed because of lack of data. The economic results show that for today's coal and gas processing the HTR can only compete against conventional conversion processes for specific premises. Especially, those processes in which valuable fossil fuels such as natural gas are substituted by nuclear process heat promise an economic bebefit. Looking to the market of the year 2030 and the need for process heat in the chemical and steel industries (including the demand for synthesis gas), cement and refinery industries, for the production of aluminium oxide and for tertiary oil recovery, a total theoretical market in the Federal Republic of Germany of up to 60 HTR-2 module plants is estimated.

2105 Power Reactors, Breeding

Refer also to citation(s) 26535, 26539, 26578, 26594

26508 (CONF-890555–1) **Inference of physical phenomena from FFTF [Fast Flux Test Facility] noise analysis.** Thie, J.A.; Damiano, B.; Campbell, L.R. Oak Ridge National Lab., TN (USA). 1989. 16p. DOE Contract AC05-84OR21400. From 7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989. Order Number DE89008747/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The source of features observed in noise spectra collected by an automated data collection system operated by the Oak Ridge National Laboratory at the Fast Flux Test Facility (FFTF) can be identified using a methodology based on careful data observation and intuition. When a large collection of data is available, as in this case, automatic pattern recognition and parameter storage and retrieval using a data base can be used to extract useful information. However, results can be limited to empirical signature comparison monitoring unless an effort is made to determine the noise sources. This paper describes the identification of several FFTF noise data phenomena and suggests how this understanding may lead to new or enhanced monitoring. 13 refs., 4 figs.

26509 (EUR–11610) **TPLOT: An interactive data management system for transient problems 3. Edition.** Doron, R. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 46p. Available from NTIS (US Sales Only), PC A03/MF A01.

This report describes the use of an interactive data management system suitable for post-processing of transient structural problems. The system is designed for IBM compatible environment (TSO command procedures) and makes use of PLOT-10 (TEKTRONIX) for graphical output (time plots). Interfaces are provided for experimental data and for various programs used in fast reactor safety analysis (EURDYN, SEURBNUK, ASTARTE, FRAP-T5, RODSWELL, SIMMER, TRACRUF, PHEAT, JOULE). Some examples are given to illustrate the system.

26510 (HEDL-SA–3324) **Breached fuel location in FFTF by delayed neutron monitor triangulation.** Bunch, W.L.; Tang, E.L. Hanford Engineering Development Lab., Richland, WA (USA). Oct 1985. 31p. DOE Contract AC06-76FF02170. (CONF-851115–55: American Nuclear Society winter meeting, San Francisco, CA, US, November 10, 1985). Order Number DE89010133/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fast Flux Test Facility (FFTF) features a three-loop, sodium-cooled 400 MWt mixed oxide fueled reactor designed for the irradiation testing of fuels and materials for use in liquid metal cooled fast reactors. To establish the ultimate capability of a particular fuel design and thereby generate information that will lead to improvements, many of the fuel irradiations are continued until a loss of cladding integrity (failure) occurs. When the cladding fails, fission gas escapes from the fuel pin and enters the reactor cover gas system. If the cladding failure permits the primary sodium to come in contact with the fuel, recoil fission products can enter the sodium. The presence of recoil fission products in the sodium can be detected by monitoring for the presence of delayed neutrons in the coolant. It is the present philosophy to not operate FFTF when a failure has occurred that permits fission fragments to enter the sodium. Thus, it is important that the identity and location of the fuel assembly that contains the failed cladding be established in order that it might be removed from the core. This report discusses method of location of fuel element when cladding is breached.

26511 (INIS-SU–77/A, pp. 23-32) **Status and prospects of activities on fast reactors.** Kazachkovskij, O.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–:

1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

This paper describes a status of works on fast reactors. It is shown that these reactors are ready for industrial implementation from technical and technological point of view. The ways of further improvement of fast reactor design are analysed. 1 tab.

26512 (INIS-SU–77/A, pp. 305-309) **Library of evaluated macroscopic experiments for fast critical assemblies and reactors.** Korobejnikova, L.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Manturov, G.N.; Tsibulya, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The LEMEX computerized library, designed for storing evaluated data of macroscopic experiments made in critical assemblies, and those of integral experiments with standard spectra, as well as the results of their calculational analysis, is described. The library is intended for the calculation of fast reactor physical characteristics. The calculational accuracy is 0.5-2.0%. 12 refs.

26513 (INIS-SU–77/A, pp. 423-427) **Reliability of evaluating the Doppler effect for uranium and plutonium isotopes in forbidden resonance range.** Koshcheev, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Tsibulya, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

When analyzing the accuracy of cross section self-shielding factors and the Doppler temperature gains in the range of forbidden resonances for uranium and plutonium isotopes, the evaluation of the corresponding error in the calculated characteristics of the BN-1600 perspective fast breeder reactor is made. 2 refs.; 4 tabs.

26514 (WHC-SA–0091) **Identification of a breached fuel pin in the Interim Examination and Maintenance Cell.** McGuiness, P.W.; Kalk, J.J.; Hicks, D.F. Westinghouse Hanford Co., Richland, WA (USA). Sep 1987. 23p. DOE Contract AC06-87RL10930. (CONF-8711195–5: American Nuclear Society winter meeting, Los Angeles, CA, US, November 15, 1987). Order Number DE89010105/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the Interim Examination and Maintenance (IEM) Cell, experiments are routinely disassembled and examined following irradiation in the Fast Flux Test Facility (FFTF). Recently and for the first time, a fueled experiment which had breached its cladding during irradiation was disassembled in the cell. The processing objective was to locate and identify the one pin (out of 217 pins) with breached cladding, and recover selected test pins for further examination. Identification of the breached pin proved to be challenging. After all pins were weighed the data were inconclusive, and alternate procedures had to be developed and implemented. Ultimately, four independent methods were used to pinpoint the breached pin.

26515 (WHC-SA–0422) **Industrial radiography.** Jackson, C.N. Jr. Westinghouse Hanford Co., Richland, WA (USA). Sep 1988. 7p. DOE Contract AC06-87RL10930. (CONF-8810347–1: Governor's conference, Spokane, WA, US, October 7, 1988). Order Number DE89010097/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Westinghouse Hanford obtains a wide range of high-quality radiographs in support of its nuclear program. We emphasize safety in all of our work. Safe operation of both x-ray machines and radioactive isotope sources is of primary importance. This effort has paid off; no injuries have been caused by radiography. As safety techniques have been perfected, they have been shared with the rest of the technical community. This is accomplished by the participation of Westinghouse Hanford personnel on national committees and by publishing findings, such as the need for periodic x-ray of the source tubes. X-ray safety and general safety conditions are emphasized in the control documentation, training, equipment design, and more importantly in the operation of the x-ray and gamma ray devices. 4 refs.

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

26516 (CEA-CONF–9696) **Space nuclear power studies in France. - A new concept of particle bed reactor.** Vrillon, B.; Carre, F.; Proust, E. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1988. 13p. (CONF-880702–: 23. intersociety energy conversion engineering conference, Denver, CO, US, July 31, 1988). Order Number DE89764001/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A cooperative program about space nuclear turboelectric space power systems was initiated in 1982 by both the Centre National d'Etudes Spatiales (CNES) and the Commissariat a l'Energie Atomique (CEA) agencies of the French government, with a view to assessing the feasibility, the lead time and the cost for the development of nuclear space power systems relevant to the power range of 20 to 400 kWe. The effort on conceptual studies recently shifted towards low power systems (20 kWe). In order to widely cover the range of possible technologies for the 20-kWe space power systems, and to assess the impact of the reactor concept (liquid metal versus gas cooled) and of the relevant operating temperature upon the system performances, a set of three reference turboelectric systems were selected for comparison. Those considered for both extreme bounds of the explored range of maximum heat source temperature (970 K and 1470 K), use a liquid metal cooled reactor (sodium or Nak and lithium respectively) and the basic features of the 200 kWe system. In addition to both liquid metal cooled systems, a third system using a gas cooled epithermal particle bed reactor, to drive a direct cycle conversion system with a turbine inlet temperature of 1120 K is being investigated; this system is intended to make full use of the heat resisting materials and of the techniques, which have been developed for the high temperature gas cooled reactors.

26517 (CEA-CONF–9697) **Space nuclear power studies in France - overview of the Erato program.** Proust, E.; Carre, F.; Chaudourne, S.; Gervaise, F.; Keirle, P.; Tilliette, Z.; Trouve, J.; Vrillon, B. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1988. 6p. (CONF-880702–: 23. intersociety energy conversion engineering conference, Denver, CO, US, July 31, 1988). Order Number DE89764002/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

A cooperative program about nuclear space power systems has been initiated in 1982 by both CNES (Centre National d'Etudes Spatiales) and CEA (Commissariat a l'Energie Atomique) with a view to assessing the feasibility, the lead time, and the cost of nuclear space power systems of the 20 to 400 kWe class. A first study phase, completed in mid 1986, has been devoted to preliminary feasibility and cost studies of a reference 200 kWe turboelectric power system ERATO compatible with the ARIANE V launcher. The present three-year study phase is mainly oriented toward the assessment of the potential advantages of nuclear power systems over solar dynamic and photovoltaic systems, within the 20 kWe power range, which corresponds to the expected power needs of the first European space missions. This paper is intended to give an overview of the present program phase, with emphasis on the design studies dedicated to three concepts of 20 kWe nuclear turboelectric power systems selected for comparison against non nuclear power systems.

26518 (CEA-CONF–9698) **Adaptability of Brayton cycle conversion systems to fast, epithermal and thermal spectrum space nuclear reactors.** Tilliette, Z.P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes

Mecaniques et Thermiques. 1988. 6p. (CONF-880702–: 23. intersociety energy conversion engineering conference, Denver, CO, US, July 31, 1988). Order Number DE89764003/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

As reported in several papers these last four years, the two French Government Agencies C.N.E.S. (Centre National d'Etudes Spatiales) and C.E.A. (Commissariat a l'Energie Atomique) are carrying out joint preliminary studies on space nuclear power systems for future ARIANE 5 launch vehicle applications. Following a two-year 200 kWe system investigation (1984-1985), the present three-year (1986-1989) program mainly considers low power levels around 20/25 kWe. The Brayton cycle is the reference conversion system, whether the heat source is a liquid metal-cooled (NaK, Na or Li) reactor or a gas-cooled direct cycle concept. The search for an adequate uilization of this energy conversion means has prompted additional evaluations featuring the definition of satisfactory cycle conditions for these various kinds of reactor concepts. In addition to firstly studied fast and epithermal spectrum ones, thermal spectrum reactors can offer an opportunity of bringing out some distinctive features of the Brayton cycle, in particular for the temperature conditioning of the efficient metal hydrides (ZrH, Li_7H) moderators. One of the purposes of the paper is to confirm the potential of long lifetime ZrH moderated reactors associated with a gas cycle and to assess the thermodynamical consequences for both NaK(Na)-cooled or gas-cooled nuclear heat sources. This investigation is complemented by the definition of appropriate reactor arrangements which could be presented on a further occasion.

26519 (ORNL/TM–10907) **Review of oxidation of Nb-1Zr.** DiStefano, J.R. Oak Ridge National Lab., TN (USA). Apr 1989. 34p. DOE Contract AC05-84OR21400. Order Number DE89010299/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A major objective of the SP-100 Program Nuclear Assembly Test is to demonstrate the performance of a full-scale nuclear subsystem of a 100-kWe space nuclear power supply. The test will be run in a large vacuum chamber to protect the Nb-1Zr components from oxidation during operation. Much information about the oxidation of niobium and Nb-1Zr alloy already exists, and previous work in this area is reviewed. Oxidation of Nb-1Zr can proceed by solution, internal oxidation, and/or film formation. At temperatures up to about 650 K (377°C), oxidation generally follows a parabolic rate law because of the formation of protective oxide(s). At higher temperatures, oxidation becomes linear, but results are extremely sensitive to pressure and other system variables. Results obtained by several investigators could not be predicted using empirical equations developed by one investigator relating the increase in oxygen concentration to pressure, temperature, time, and specimen thickness. Additional data are required to provide more reliable guidelines for system operation that will protect against catastrophic effects. 20 refs., 12 figs., 7 tabs.

2107 Regulation and Licensing

Refer also to citation(s) 26309

26520 (NUREG–0040-Vol.12-No.4) **Licensee contractor and vendor inspection status report: Quarterly report, October 1988–December 1988.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards. Apr 1989. 57p. Available from NTIS, PC A04/MF A01 - GPO - OSTI.

This periodical covers the results of inspections performed by the NRC's Vendor Inspection Branch that have been distributed to the inspected organization during the period from October 1988 through December 1988.

26521 (NUREG/CR–5332) **Summary and analysis of public comments on NUREG-1317: Regulatory options for nuclear plant license renewal: Final report.** Ligon, D.M.; Seth, S.S. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; Mitre Corp., McLean, VA (USA). Mar 1989. 57p. (MTR–89W00031). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

On August 29, 1988, the US Nuclear Regulatory Commission (NRC) issued an Advance Notice of Proposed Rulemaking on nuclear plant license renewal and solicited public comments on NUREG-1317, "Regulatory Options for Nuclear Plant License Renewal." NUREG-1317 presents a discussion of fifteen topics involving technical, environmental, and procedural issues and poses a set of related questions. As part of its ongoing task for the NRC, The MITRE Corporation has summarized and analyzed the public comments received. Fifty-three written comments were received. Of these, 83 percent were from nuclear industry representatives; the remaining comments represented federal and state agencies, public interest groups, and a private citizen.

26522 **Licensing fuel for extended burnup operation.** Beyer, C.E. (Battelle-Pacific Northwest Labs., Richland, WA (US)); Lobel, R. *Transactions of the American Nuclear Society (USA)*, 54(1): 92 (1987). (CONF-870837–: 13. American Nuclear Society international meeting on nuclear power plant operation, Chicago, IL, US, August 30, 1987).

During the last 5 yr, the U.S. Nuclear Regulatory Commission (NRC) has received several licensing submittals in support of applications for extended burnup fuel operation. These licensing submittals can be divided into three categories: general topical reports submitted by each fuel vendor that demonstrate that no generic problems exist for extended burnup operation; new criteria and analytical models submitted for use in analyses in support of extended burnup operation; and fuel design changes submitted specifically for extended burnup operation. Each of these licensing submittals has been reviewed by the NRC to assure that extended burnup operation will result in safe fuel operation and no degradation in fuel performance.

2108 Economics

Refer also to citation(s) 26485, 26493, 26497, 26507

26523 (INIS-BR–1458, pp. 238) **Safer nuclear reactors: fission and fusion.** Miley, G.H. (Illinois Univ., Urbana (USA). Dept. of Nuclear Engineering). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

D-T REACTORS/comparative evaluations; REACTOR SAFETY/comparative evaluations

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 27617

26524 (BLG–600) **Reactor Division semestrial progress report January - June 1987.** Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). 1987. 152p. Order Number DE89611033/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This report covers the activities of the reactor division at the SCK-CEN during the first semester of 1987. It deals with the BR-2 materials testing reactor, the BR-3 power plant, reactor physics, water cooled reactors, fast neutron reactors, fusion, non nuclear programmes, testing and commissioning, high and medium activities, and informatics. (MCB).

2201 Theory and Calculation

Refer also to citation(s) 27576

26525 (INIS-SU–77/A, pp. 45-49) **Library of files of evaluated neutron data.** Blokhin, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Ignatyuk, A.V.; Koshcheev, V.N.; Kuz'minov, B.D.; Manokhin, V.N.; Manturov, G.N.; Nikolaev, M.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

It is reported about development of the evaluated neutron data files library which was recommended by the GKAE Nuclear Data Commission as the base of improving constant systems in neutron engeneering calculations. A short description of the library content is given and status of the library is pointed out. 16 refs.

26526 (INIS-SU–77/A, pp. 121-126) **Facility for measuring the space-even asymmetry in neutron-nucleus cross section at the accuracy level of 10^{-7}.** Bondarenko, L.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Zhukov, S.V.; Kuznetsov, V.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yademykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A facility for measuring weak polarization of a thermal neutron beam, which arises due to parity violation in a total neutron-nucleus cross section, is described. Magnetically saturated iron with the analyzing ability of 0.36 is used as a polarimeter. The facility allows the rms accuracy to be achieved in measuring the asymmetry of the total cross section of $2x10^{-7}$ during, approximately, 100 h of continuous measurement. 5 refs.; 3 figs.

26527 (INIS-SU–77/A, pp. 348-352) **Analysis of experiments in critical assemblies aimed at testing constant collections for reactor calculations.** Gomin, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Kapitonova, A.V.; Kononov, S.L. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yademykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

To test the accuracy of constant collections for reactor calculations, the calculations for critical assemblies with the following compositions: (^{235}U,^{238}U,H_2O), (^{235}U,^{238}U,D_2O), (^{239}Pu,U,H_2O),(^{233}U,^{232}Th,H_2O) are made using the Monte Carlo method. Neutron multiplication factors, ^{235}U fission ratios above and below the cadmium boundary, ratios of ^{238}U and ^{235}U fissions, ^{238}U capture-to- ^{235}U fission ratios, as well as probabilities of neutron leakage, are determined. The conclusion is made that the reliability of the data on neutron constants for ^{233}U, ^{235}U, ^{238}U and ^{232}Th on the whole satisfies the requirements to the calculational accuracy for the modern thermal power reactors. The ^{239}Pu cross section requires refining in the range of resonance energies. 15 refs.; 8 tabs.

2202 Components and Accessories

Refer also to citation(s) 26545, 26745, 26898, 26905

26528 (CONF-8904156–1) **The sequence coding and search system: An approach for constructing and analyzing event sequences at commercial nuclear power plants.** Mays, G.T. Oak Ridge National Lab., TN (USA). Apr 1989. 16p. DOE Contract AC05-84OR21400. From CSNI-CEC specialist meeting on trends and pattern analyses of operational data from nuclear power plants; Rome, IT; April 3, 1989. Order Number DE89008929/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Nuclear Regulatory Commission (NRC) has recognized the importance of the collection, assessment, and feedstock of operating experience data from commercial nuclear power plants and has centralized these activities in the Office for Analysis and Evaluation of Operational Data (AEOD). Such data is essential for performing safety and reliability analyses, especially analyses of trends and patterns to identify undesirable changes in plant performance at the earliest opportunity to implement corrective measures to preclude the occurrences of a more serious event. One of NRC's principal tools for collecting and evaluating operating experience data is the Sequence Coding and Search System (SCSS). The SCSS consists of a methodology for structuring event sequences and the requisite computer system to store and search the data. The source information for SCSS is the Licensee Event Report (LER), which is a legally required document. This paper describes the objective SCSS, the information it contains, and the format and approach for constructuring SCSS event sequences. Examples are presented demonstrating the use SCSS to support the analysis of LER data. The SCSS contains over 30,000 LERs describing events from 1980 through the present. Insights gained from working with a complex data system from the initial developmental stage to the point of a mature operating system are highlighted.

26529 (EPRI-GS–6317) **International cooling-tower conference: Proceedings.** Dinelli, G.; Bellagamba, B. (eds.). Electric Power Research Inst., Palo Alto, CA (USA); Ente Nazionale per l'Energia Elettrica, Pisa (Italy). Thermal and Nuclear Research Center. Apr 1989. 569p. (CONF-8810350–: 6. cooling tower workshop of the International Association for Hydraulic Research, Pisa, IT, October 4, 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This document contains the manuscripts of 27 papers that were presented at the 6th Cooling Tower Workshop of the International Association for Hydraulic Research, held at the facilities of ENEL-CRTN (Italian Power Authority, Thermal and Nuclear Research Center, Pisa, Italy), during the period October 4-7, 1988. This report also includes minutes of round table discussions on optimization methods, engineering standards, and materials selection. This document represents a worldwide state-of-the-art survey of recent work on cooling tower performance and environmental impacts.

26530 (EPRI-NP–6260-M) **Criteria and guidelines for predicting concrete containment leakage.** Dameron, R.A.; Dunham, R.S.; Rashid, Y.R.; Sullaway, M.F. Electric Power Research Inst., Palo Alto, CA (USA); ANATECH Research Corp., San Diego, CA (USA). Apr 1989. 137p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report draws on five years of EPRI-sponsored research for developing a test validated methodology for predicting the overpressure behavior of concrete containments. The evidence discovered during this comprehensive research program points to leakage as the dominant failure mode for concrete containments, so the thrust of this report is to present the bases and justification of this failure mode and of the development of a simplified criteria for predicting concrete containment leakage. First, an overview of the experimental and analytical evidence is presented. Second, liner tearing mechanisms that have been exhibited in a variety of tests are examined in detail in order to postulate a simplified approach for predicting liner tearing. The simplified approach that has been developed consists of guidelines for performing simplified 2D analysis of containments to produce global liner strain predictions in the absence of structural discontinuities. These predictions are used with sets of curves of strain magnification factors which are due to strain concentration near structural discontinuities, strain gage length effects, and liner stress triaxiality conditions. The report gives examples of how the strain concentration factor curves were developed, and it describes step-by-step instructions for using the methodology along with a comprehensive example application for a reinforced concrete and a prestressed concrete containment. 16 refs., 58 figs.

26531 (NUREG/CR–5208) **Warm prestress modeling: Comparison of models and experimental results.** Stonesifer, R.B.; Rybicki, E.F.; McCabe, D.E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA). Apr 1989. 76p. (MEA–2305). Available from NTIS, PC A05/MF A01 - GPO - OSTI.

Warm prestress (WPS) behavior is the term commonly used to describe an apparent increase in material toughness of pressure vessel steels resulting from previous loading at a higher temperature. Such load histories are of interest largely due to the fact that loss of coolant accident (LOCA) and pressurized thermal shock (PTS) related load histories are expected to result in WPS behavior. While previous experimental work has demonstrated WPS behavior, insufficient attention has been given to separating material toughness variability for the WPS effect. There also appears to be a basic lack of understanding of the mechanism by which WPS behavior occurs and as a result, there is no generally accepted model or fracture criterion for predicting WPS behavior. The objectives of

this study were to develop WPS data for which the enhanced toughness due to WPS could be separated from the K_{Ic} variability of the virgin material and to evaluate several candidate WPS models. 33 refs., 17 figs., 5 tabs.

26532 (SAND–88-1638C) **An overview of the round-robin analysis of the 1:6-scale reinforced concrete containment model.** Clauss, D.B. Sandia National Labs., Albuquerque, NM (USA). 1988. 10p. DOE Contract AC04-76DP00789. (CONF-890561–3: American Society of Civil Engineers (ASCE) structures conference, San Francisco, CA, US, May 1, 1989). Order Number DE89003140/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The results of nonlinear structural analyses of a 1:6-scale reinforced concrete model, which were independently conducted by ten different organizations, are briefly described and compared with the results of a pressure test to failure. The emphasis is primarily on the undisturbed response of the shell, i.e., the effect of penetrations is not considered. 4 refs., 3 figs., 1 tab.

2203 Fuel Elements

Refer also to citation(s) 26522, 26969

26533 (IEA-PUMA-R-B–2012) **Effective methods of solving of model equations of certain class of thermal systems.** Lach, J. Institute of Atomic Energy, Otwock-Swierk (Poland). 1985. 247p. (In Polish). Order Number DE88706281/JAW. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

Received in March 1988.

A number of topics connected with solving of model equations of certain class of thermal systems by the method of successive approximations is touched. A system of partial differential equations of the first degree, appearing most frequently in practical applications of heat and mass transfer theory is reduced to an equivalent system of Volterra integral equations of the second kind. Among a few sample applications the thermal processes appearing in the fuel channel of nuclear reactor are solved. The theoretical analysis is illustrated by the results of numerical calculations given in tables and diagrams. 111 refs., 17 figs., 16 tabs.

2204 Control Systems

Refer also to citation(s) 26481, 26571, 26594, 26595

26534 (CONF-890555–2) **An intelligent simulation environment for control system design.** Robinson, J.T. Oak Ridge National Lab., TN (USA). 1989. 12p. DOE Contract AC05-84OR21400. (CONF-890360–3: 7. power plant dynamics, control and testing symposium, Knoxville, TN, US, May 15, 1989). Order Number DE89008744/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Oak Ridge National Laboratory is currently assisting in the development of advanced control systems for the next generation of nuclear power plants. This paper presents a prototype interactive and intelligent simulation environment being developed to support this effort. The environment combines tools from the field of Artificial Intelligence; in particular object-oriented programming, a LISP programming environment, and a direct manipulation user interface; with traditional numerical methods for simulating combined continuous/discrete processes. The resulting environment is highly interactive and easy to use. Models may be created and modified quickly through a window oriented direct manipulation interface. Models may be modified at any time, even as the simulation is running, and the results observed immediately via real-time graphics. 8 refs., 3 figs.

26535 (CONF-890555–6) **Approach to plant automation with evolving technology.** White, J.D. Oak Ridge National Lab., TN (USA). 1989. 23p. DOE Contract AC05-84OR21400. From 7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989. Order Number DE89008918/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy has provided support to Oak Ridge National Laboratory in order to pursue research leading to advanced, automated control of new innovative liquid-metal-cooled nuclear power plants. The purpose of this effort is to conduct research that will help to ensure improved operability, reliability, and safety for advanced LMRs. The plan adopted to achieve these program goals in an efficient and timely manner consists of utilizing, and advancing where required, state-of-the-art controls technology through close interaction with other national laboratories, universities, industry and utilities. A broad range of applications for the control systems strategies and the design environment developed in the course of this program is likely. A natural evolution of automated control in nuclear power plants is envisioned by ORNL to be a phased transition from today's situation of some analog control at the subsystem level with significant operator interaction to the future capability for completely automated digital control with operator supervision. The technical accomplishments provided by this program will assist the industry to accelerate this transition and provide greater economy and safety. The development of this transition to advanced, automated control system designs is expected to have extensive benefits in reduced operating costs, fewer outages, enhanced safety, improved licensability, and improved public acceptance for commercial nuclear power plants. 24 refs.

26536 (CONF-8711245–3) **An expert system for nuclear plant malfunction consequences, implemented and tested on a reactor simulator.** Bruschi, R.; Di Porto, P.; Pallottelli, R. ENEA, Rome (Italy). Nov 1987. 11p. From Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, IT; November 19, 1987. Order Number DE89770344/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at ENEA-Halden reactor project workshop on computer applications for nuclear power and industrial process plant operation and control (Rome, 19-20 Nov 1987).

The proposed system is composed of different phases. In the first phase, the early detection of malfunctions is realized, to identify the origin of malfunctioning conditions. In the second one, "previsional" methods are developed, showing very rapidly the probable evolution of an uncontrolled accidental condition. These techniques are implemented on a nuclear power plant simulator.

26537 (CONF-8711245–4) **Review of display format and MMC of computer based information system in hybrid control room.** Sepielli, M. ENEA, Rome (Italy). Nov 1987. 27p. From Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, IT; November 19, 1987. Order Number DE89770345/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at ENEA-Halden reactor project workshop on computer applications for nuclear power and industrial process plant operation and control (Rome, 19-20 Nov 1987).

One of the most relevant parameters in nuclear power plant safety and operability, the man-machine interface, is discussed. This paper deals with the assessment of Video-unit displays and Man-System Communication used in a Computerized Monitoring System located in a hybrid Control Room in Italian BWR-6NPP.

26538 (CONF-8711245–5) **An industrial test environment for safety critical software testing.** Bologna, S.; Ratto, S.; Ciancamerla, E.; Badii, G. ENEA, Rome (Italy). Nov 1987. 24p. From Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, IT; November 19, 1987. Order Number DE89770347/JAW. Available from NTIS (US Sales Only), PC A03.

Paper presented at Workshop on computer applications for nuclear power and industrial process plant operation and control (Rome, 19-20 Nov 1987).

The paper presents an integrated test environment designed and implemented to test software written for safety critical applications. The use of a sofisticated test environment is an essential condition to guarantee a controlled execution of the test activity, its traceability and adequate documentation. The integrated test environment has been specifically developed inside the framework for the development of the Integrated Protection System (IPS), which, under the responsibility of Westinghouse, has the partecipation of various Italian organizations, each contributing in different areas of expertise. In this framework, ENEA (Italian Nuclear and Alternative Energy Agency) provides the facilities and manpower to perform the IPS

software verification activities and leads all verification activities that are conducted in Italy by ENEA-ESACONTROL-SEPA personnel.

26539 (DOE/NE/37959–28) **Development of an integrated signal validation system and application to operating power plants.** Upadhyaya, B.R.; Holbert, K.E.; Kerlin, T.W. Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering. 1989. 19p. DOE Contract AC02-86NE37959. (CONF-890555–10: 7. power plant dynamics, control and testing symposium, Knoxville, TN, US, May 15, 1989). Order Number DE89010052/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of the university-industry joint research program at the University of Tennessee and Combustion Engineering, Inc. is to develop and implement a comprehensive signal validation system for current power plants and future advanced reactors. The integrated system consists of several parallel signal processing modules. The multi-modular decision information is combined to detect, isolate and characterize faulty signals. The signal validation system has been implemented in a VAX workstation and applied to operational data from a pressurized water reactor (PWR) and the Experimental Breeder Reactor-II (EBR-II). The use of the various signal validation techniques may be extended to predictive maintenance advising, instrument calibration verification, and to the development of intelligent instrumentation systems. 18 refs., 6 figs.

26540 (DOE/NE/37959–29) **Generalized consistency checking of multivariable redundant measurements and common-mode failure detection.** Glockler, O.; Upadhyaya, B.R.; Morgenstern, V.M.; Olvera, J. Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering. 1989. 23p. DOE Contract AC02-86NE37959. (CONF-890555–11: 7. power plant dynamics, control and testing symposium, Knoxville, TN, US, May 15, 1989). Order Number DE89010053/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The limitations of the single-variable consistency checking algorithm for validating redundant measurements are remedied by extending it to multiple process signals. The redundant measurements of each variable in a subsystem are combined with an estimate of the variable using prediction models. A complex logic algorithm has been developed to perform simultaneous consistency checking of all variables under consideration. The new algorithm has been implemented in a general purpose PC and in a VAX workstation. Applications to sensor failure monitoring and to detect and isolate common-mode sensor failures are studied. 3 refs., 21 figs.

26541 (DOE/NE/37959–30) **Signal validation for nuclear power plants: Progress report No. 8, January–March 1989.** Upadhyaya, B.R.; Kerlin, T.W. Tennessee Univ., Knoxville, TN (USA). Dept. of Nuclear Engineering. 28 Mar 1989. 4p. DOE Contract AC02-86NE37959. Order Number DE89010054/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report is a summary of the progress in the US Department of Energy sponsored project on Signal Validation for Nuclear Power Plants, for the period January–March, 1989. This is the last phase of the project with September 29, 1989 as the official ending date. A preliminary draft of a two-volume final report is scheduled for release in mid-September.

26542 (EPRI-NP–6340) **Applying machinery vibration monitoring: Final report.** Bond, T.H. Electric Power Research Inst., Palo Alto, CA (USA); Advanced Science and Technology Associates, Inc., Solana Beach, CA (USA). Apr 1989. 50p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This project report presents the applications of vibration monitoring in selected utilities with emphasis on how their programs support plant policies and goals. Five utilities were visited, the program managers were interviewed, and the execution of their programs were observed. The report concentrates on the periodic monitoring program used primarily in the balance of plant. The approach of the utility in the use of the vibration monitoring program is seen in the description of example programs. The selection of data collectors and computer software to analyze and trend the results of the routine surveys influences the number of supported machines in the program. The integration of the lubricating oil analyses with the vibration monitoring results gives two of the utilities seen an early look at impending bearing problems. A simple method of recognizing the costs saved and treating the positive benefits is described.

26543 (NUREG–1342) **A status report regarding industry implementation of safety parameter display systems.** Lapinsky, G.W., Jr.; Eckenrode, R.J.; Goodman, P.C.; Correia, R.P. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Licensee Performance and Quality Evaluation. Apr 1989. 44p. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

This report provides a summary of the results of the US Nuclear Regulatory Commission staff's review of installed safety parameter display systems (SPDS) at 57 nuclear units. The staff describes its rationale and practice for determining acceptability of some of the methods for satisfying the various requirements for SPDS as well as some methods that the staff has not accepted. The staff's discussion of identified strengths and weaknesses should aid licensees in solving some of the problems they may be experiencing with their SPDS.

26544 (WHC-SA–0280) **Preliminary results from the N Reactor incore detector system.** Crowe, R.D.; Toffer, H. Westinghouse Hanford Co., Richland, WA (USA). Sep 1988. 10p. DOE Contract AC06-87RL10930. (CONF-880911–34: International reactor physics conference, Jackson Hole, WY, US, September 18, 1988). Order Number DE89010098/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper contains a description of the first full implementation of an incore neutron surveillance system utilizing pairs of rhodium and hafnium self-powered detectors (SPNDs) in a large graphite-moderated reactor. This combination of detectors achieves a prompt response coupled with high accuracy. Results of preliminary measurements showing the response of the self-powered neutron detectors for a range of reactor conditions will demonstrate the capabilities of the installed system. 2 refs., 9 figs.

26545 **Reliability technology to improve and/or maintain emergency diesel generator performance.** Karimian, S. (Brookhaven National Lab., Upton, NY (US)); Taylor, J.H. *Transactions of the American Nuclear Society (USA),* 54(1): 116 (1987). (CONF-870837–: 13. American Nuclear Society international meeting on nuclear power plant operation, Chicago, IL, US, August 30, 1987).

This paper reviews a report that demonstrates that an emergency diesel generator reliability program can be developed using risk- and reliability-based techniques that can be integrated within current plant operational activities to (a) analyze problems that have affected emergency diesel generator (EDG) performances, (b) forecast the onset of potential problems, and (c) suggest actions that could eliminate or reduce their occurrence. With only a few exceptions, commercial NPPs in the United States use EDG units as backup sources. These EDG units consist of a diesel engine connected directly to an ac generator. They are safety grade and are normally arranged so that separate EDGs supply each of the two, three, or four redundant electrical divisions of the NPP. The EDGs are typically designed to start automatically, to be at rated speed and voltage in 10 s, and to accept full load within 1 min.

26546 **Pattern-recognition software for plant surveillance.** Mott, J. (Energy Inc., Idaho Falls, ID (US)); Young, J.; Bertch, W.; King, R.W. *Transactions of the American Nuclear Society (USA),* 54(1): 151 (1987). (CONF-870837–: 13. American Nuclear Society international meeting on nuclear power plant operation, Chicago, IL, US, August 30, 1987).

A power plant in steady-state operation has almost all plant signals in definite relations to each other, and a new approach to plant surveillance, which compares the patterns representing these relations, has been used to measure the consistency of many plant signals simultaneously and so derive a measure of the validity of each individual signal. In the application of this process, the real plant is used as a model from which to learn the pattern relations, and the surveillance function compares learned signal values with currently observed signal values by using contrast-enhancing, pattern-recognition algorithms. System state analyzer (SSA) software embodying this technique has been developed for the daily surveillance of the Experimental Breeder Reactor-II (EBR-II) at the Argonne National Laboratory-West site.

26547 Fuel performance in the United States. Bailey, W.J. (Battelle-Pacific Northwest Labs., Richland, WA (US)); Wu, S.; Lobel, R. *Transactions of the American Nuclear Society (USA)*, 54(1): 161 (1987). (CONF-870837–: 13. American Nuclear Society international meeting on nuclear power plant operation, Chicago, IL, US, August 30, 1987).

Monitoring in-reactor performance of nuclear fuel in U.S. commercial light water reactors yields important feedback for safety considerations and licensing procedures. A series of annual reports (the most recent is eighth, which covers 1985) has been implemented by the U.S. Nuclear Regulatory Commission through a program at Battelle-Pacific Northwest Laboratories in which fuel performance is evaluated and annual summaries are prepared. Events involving fuel and fuel-related systems are also described in the reports. This paper describes their findings.

2205 Environmental Aspects

Refer also to citation(s) 26569, 27163

26548 (DOE/ID–10216-Vol.1) **Modifications for the development of the MAAP-DOE code: Volume 1, A mechanistic model for core-concrete interactions and fission product release in integrated accident analysis Task 3.4.3.** McCartney, M.A.; Plys, M.G. Fauske and Associates, Inc., Burr Ridge, IL (USA). Nov 1988. 114p. DOE Contract AC07-76ID01570. Order Number DE89009979/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A core-concrete interaction model has been developed for the ARSAP program which is suitable for anticipated advanced light water reactor needs. The new molten debris-concrete attack model allows for unequal sideward and downward erosion rates. Heat transfer rates are independently calculated in each direction, and conduction into the concrete also occurs independently in each direction. Debris properties are more accurately represented by using data for each compound. Debris solidification calculations are based on phase diagrams which allow single- or two-phase debris surrounded by a crust. The new model was exercised for selected tests from three series of experiments. The model predictions for concrete erosion, fission product release and debris temperature compared well with experimental results. 18 refs., 49 figs., 13 tabs.

26549 (DOE/ID–10216-Vol.4) **Modifications for the development of the MAAP-DOE code: Volume 4, Fission product release during high-pressure melt ejection: Task 3.4.6.** Henry, R.E. Fauske and Associates, Inc., Burr Ridge, IL (USA). Nov 1988. 62p. DOE Contract AC07-76ID01570. Order Number DE89009982/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A model has been developed to predict the fission product release and possible dispersal from the reactor cavity during primary system blowdown following melt-through of the reactor vessel lower head. The model provides the basis for debris particulation and the diffusion of materials from the particulated debris into the containment atmosphere. The resulting temperature and pressure rise of the containment due to the dispersal of the debris into the containment atmosphere is also calculated. The model compares favorably with experimental results on direct containment heating and with the release of fission product simulants. 15 refs., 12 figs., 13 tabs.

26550 (DOE/ID–10216-Vol.7) **Modifications for the development of the MAAP-DOE code: Volume 7: A best-estimate correlation of in-vessel fission product release for severe accident analyses WBS 3.4.9.** Suh, Kune Y. Fauske and Associates, Inc., Burr Ridge, IL (USA). Jan 1989. 54p. DOE Contract AC07-76ID01570. Order Number DE89009654/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Best-estimate calculations of realistic source terms are presented which reduce uncertainties in predicting fission product release from the UO_2 fuel over the temperature range 770 K to 3000 K. The new correlation explicitly accounts for the fuel morphology effects of fuel grain size variation and fuel-cladding interaction. The model is used to simulate a large break, loss-of-coolant accident in a pressurized water reactor plant. Less and slower releases are predicted for the volatile fission products using the new mass transfer correlations as opposed to the existing literature correlations. 17 refs., 21 figs., 5 tabs.

26551 (DOE/ID–10216-Vol.8) **Modifications for the development of the MAAP-DOE code: Volume 8: Resolution of the outstanding nuclear fission product aerosol transport and deposition issues WBS 3.4.2.** Fauske and Associates, Inc., Burr Ridge, IL (USA). Dec 1988. 317p. DOE Contract AC07-76ID01570. Order Number DE89009724/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

A goal of the Department of Energy's Advanced Reactor Severe Accident Program (DOE ARSAP) is to develop an understanding of the risk associated with severe accidents (core melt) in advanced light water reactors (ALWRs). The behavior of fission products as they are transported as aerosols in the reactor's primary system and containment is part of this risk assessment. This report describes the modeling of nuclear aerosols for use in reactor safety analyses. Several outstanding issues concerning the modeling of aerosol behavior have been identified by the Nuclear Regulatory Commission (NRC) in response to the aerosol modeling performed during the Industry Degraded Core Rulemaking Program. In particular, this study addresses the issue of the applicability of the deposition correlation for the rapid release of aerosols. The NRC has taken the position that the correlations are marginally adequate for short-term releases and can only be appropriately used given sufficient time for the aerosol to approach the correlation curves. To address this issue, ARSAP has developed a sectional version of the Modular Accident Analysis Program code against which the correlation version of the same code is compared. The results indicate that the sectional method predicts about 15% more deposition than does the correlation technique. However, ARSAP has judged that this difference is not significant compared to the uncertainty of the available aerosol data for model verification and the modeling of other phenomena during the accident. Thus, ARSAP has concluded that the correlation method is a reasonable and adequate technique for such analyses.

26552 (EPRI-NP–6328) **Release of volatile fission products from irradiated LWR fuel: Mass spectrometry studies: Final report.** Johnson, I.; Johnson, C.E. Electric Power Research Inst., Palo Alto, CA (USA); Argonne National Lab., IL (USA). Apr 1989. 75p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Quadrupole mass spectrometry has been used to study the chemical form and release rate of volatile fission products effusing from an irradiated LWR fuel sample. Experiments up to a temperature of 1900°C (2173 K) have identified krypton, xenon, cesium, and tellurium as the species released from the fuel. A weak signal for atomic iodine was observed at 1050°C (1323 K). Release rates were measured under reducing conditions, as would be expected when an excess of gaseous hydrogen is present, and oxidizing conditions, as would be expected in a pure steam environment. The main conclusions from these studies are (1) the release rates of krypton and xenon from irradiated fuel are less than the previous estimates by one (oxidizing conditions) to three (reducing conditions) orders of magnitude, (2) the release rates of Cs, I, and Te are significantly lower than those of krypton and xenon; under oxidizing conditions, the release rate of Cs is zero, (3) the low release rates of Cs and I reduced the concentration of CsI below the detection limit of the mass spectrometer. In complementary experiments on nonradioactive material, it was found that the release of tellurium was hindered by dissolution in the Zircaloy cladding. Above 1300°C (1673 K), gaseous SnTe was observed; its formation is attributed to reaction of the tellurium with the tin in the Zircaloy. 17 refs., 13 figs., 10 tabs.

26553 (INIS-mf–11392) **Country plan Zeeland, predesign. Policy note reactions and answers.** Provinciale Staten Zeeland, Middelburg (Netherlands). Oct 1986. 191p. (In Dutch). Order Number DE88706284/JAW. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

In this note of the provincial executive of Zeeland the timely entered reactions on the predesign-country plan Zeeland, concerning the location of additional nuclear power plants in Borssele are elaborated. The relevance of the policy can be related to the character of the reactions on the predesign-country plan, as well as to the

character of the answers and conclusions associated with them. The answers in this note may be important as explanations of the contents of the predesign-country plan. The remarks are arranged, summarized and answered as much as possible according to the arrangement of the predesign-country plan. By subject, in each case, first the corresponding reactions are summarized, next the reactions are answered. From the conclusions it appears if and to what extent reactions may give motivations for modifications in the predesign.

26554 (IVEM–14-A) **Dutch debate on reactor safety. The intermediate situation in 1986.** Aldenkamp, F.; Biesiot, W.; Geerts, H.M.; Nienhuys, K.; Soppe, W. Rijksuniversiteit Groningen (Netherlands). Interfacultaire Vakgroep Energie en Milieukunde. Jun 1986. 46p. (In Dutch). Order Number DE88706289/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A survey is presented of the discussion on location sites for nuclear power plants in the Netherlands and the USA. It consists of two parts (A and B). This part (A) presents a summary of the discussion in the Netherlands. The name and contents of the reports which have been published are indicated briefly. Many of the Dutch reports refer to American studies on reactor safety. In order to obtain a good survey of these a description is presented of the development of the discussion in the USA after the publication of the well-known reactor safety study WASH-1400. After this survey of five important reports, an introduction is presented dealing with the background of the authors, the purposes, the main conclusions and the most salient points of criticism formulated by others. Under discussion are the reports of the IDCOR (nuclear power industry), ANS (American Nuclear Society), APS (American Physical Society), NRC (Nuclear Regulatory Commission) and UCS (Union of Concerned Scientists). 38 refs.; 5 figs.; 5 tabs.

26555 (NUREG/CR–4721) **The use of fiber optics for remote temperature measurement in fission product release tests.** Webster, C.S.; Osborne, M.F. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Oak Ridge National Lab., TN (USA). Apr 1989. 28p. DOE Contract AC05-84OR21400. (ORNL/TM–10366). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

A system for remote temperature measurement in a highly hostile environment was developed. Fiber optic cables were used to conduct light signals from a high temperature induction furnace inside a hot cell to automatic two-color pyrometers mounted outside the cell. This system was calibrated with manually operated, disappearing-filament optical pyrometers and high temperature thermocouples. This technique has provided reliable temperature data in several fission product release tests of highly irradiated reactor fuel at temperatures up to 2425°C. Compared to the previously used temperature measurement method, this technique afforded the ability to obtain more data from a smaller investment of assembly time and hot cell space, and it also increased safety through a reduction in radiation hazard to personnel and instrumentation. 3 refs., 12 figs.

26556 (SAND–88-1747C) **Containment model: Test program and results.** Horschel, D.S. Sandia National Labs., Albuquerque, NM (USA). 1988. 11p. DOE Contract AC04-76DP00789. (CONF-890561–4: American Society of Civil Engineers (ASCE) structures conference, San Francisco, CA, US, May 1, 1989). Order Number DE89002891/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories (Sandia) completed the testing of a 1:6-scale containment building for a Light Water Reactor (LWR) in July 1987. The containment building was made of reinforced concrete and had many of the features found in full-size containments. Testing consisted of a structural integrity test, an integrated leak rate test, and concluded with an overpressurization test of the structure. Highlights of the results from the overpressurization of the containment model are presented. 7 refs., 5 figs.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 26508, 26546, 26577, 26579, 27657

26557 (INIS-GB–185) **Annual report 1987-1988.** Universities Research Reactor, Risley (UK). 1988. 28p. Order Number DE89610900/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The paper presents: the annual report 1987/8 of the University Research Reactor, Risley, United Kingdom. The report contains a description of the current research programme using reactor produced isotopes and other reactor facilities. A summary of the work carried out by the Activation Analysis Service during 1987/8 is also given, along with the Reactor Teaching Programme, and the reactor operation and site safety arrangements. (U.K.).

26558 (INIS-SU–77/A, pp. 180-184) **Universal liquid-hydrogen source of polarized cold and ultracold neutrons at the VVR-M LIYaF reactor.** Altarev, I.S. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Borovikova, N.V.; Bulkin, A.P. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

An universal source of cold and ultracold neutrons produced at the WWR-M reactor is described. Liquid hydrogen moderator of the source 1l in volume is located in the centre of the reactor core and surrounded with a lead screen. The thermal neutron flux in the place of th source location is (1.5-2.0) x 10^{14} neutron $s^{-1}xcm^{-2}$. Total heat release in the source is 2 kW. Using the source considered record-breaking values of intensity and flux density of polarized cold neutrons, constituting $3x10^{10}$ neutron/s and $6x10^{18}$ neutron/sxcm^2, as well as the intensity of ultracold neutron flux constituting $5x10^5$ neutron/s at neutron flux density of $6x10^{13}$ neutron/sxcm^2, are obtained. 2 refs.; 3 figs.

26559 (INIS-SU–77/A, pp. 226-230) **Ultracold neutron source of the IRT-M reactor of the AN GSSR Physics Institute and the prospects of its application.** Abramidze, Sh.P. (AN Gruzinskoj SSR, Tbilisi (USSR). Inst. Fiziki); Bedbenov, V.S.; Vladislavskij, Yu.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Cryogenic source of cold neutrons installed in the IRT-M reactor channel is described. Crystal beryllium is used as a moderator, and gaseous helium - as a coolant. The moderator dimensions (32x25x22 cm), optimal from the viewpoint of neutron thermalization, its shape and location in the reactor reflector, are determined on the basis of the multigroup computer calculation using the Monte Carlo method. Formation of the neutron spectrum and increase of neutron flux intensity in the range of wave lengths of 1-12 A are realized by change in the moderator temperature in the range of 20-500 K. 7 refs.; 2 figs.

26560 (INIS-SU–77/A, pp. 342-347) **Evaluation of group data for reactor materials and fission products on the base of reactivity measurements in special fast critical assemblies.** Bemer, B. (7041292DD); Dittse, K.; Fermann, K.; Khyuttel', G.; Lemann, E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Using the method of neutron importance function independent of energy the reactivities of samples in the SEG-4 and SEG-5, critical assemblies created specially for the evaluation of group cross sections of standard sets of materials are measured. The results obtained show that structural materials and fission products still have considerable differences in certain data and in many cases the accuracy does not correspond to the calculational requirement for fast reactor main characteristics. As compared to it the differences in the results obtained in both systems (SEG-4 and SEG-5) are much less than the discrepancies. The new method of neutron

importance function independent of energy proved to be useful for the data evaluation. 12 refs.; 2 figs.

26561 (JINR-R–13-88-326) **Possibilities of neutron real time diffractometry at the IBR-2 pulsed reactor.** Mironova, G.M. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1988. 3p. (In Russian). Order Number DE88706339/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The unique possibility of measuring a diffraction spectrum with DN-2 diffractometer per one pulse of the IBR-2 reactor permits to investigate transient phenomena with relaxation time of about several milliseconds, time resolution being of ~ 300 microseconds. 4 refs.; 2 figs.

26562 (ORNL/TM–11150) **Bulk Shielding Facility quarterly report, October, November, and December 1988.** Laughlin, D.L.; Hamrick, T.P. Oak Ridge National Lab., TN (USA). Mar 1989. 19p. DOE Contract AC05-84OR21400. Order Number DE89010200/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Bulk Shielding Reactor (BSR) remained shut down during October, November, and December. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The Pool Critical Assembly (PCA) is shut down for shim-safety rod magnets and associated electronic components upgrading. 1 fig., 10 tabs.

26563 (ORNL/tr–89/18) **Nuclear reactor containing a water-filled pool.** Nylund, O.; Suvanto, A.; Welen, S. Oak Ridge National Lab., TN (USA). 1989. 16p. Translation of Swedish Patent Application No. 7509454-0, February 27, 1977. DOE Contract AC05-84OR21400. Order Number DE89010219/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This invention involves a nuclear reactor containing a water-filled pool and a core that is contained inside a reactor vessel that is immersed in a pool and equipped with an air-tight cover, whereby the cover is equipped with inlets for a number of drive shafts, each of which has a control rod as well as its own control rod drive arranged above the reactor core. A nuclear reactor in accordance with this invention is particularly designed as a heat source in a district heating plant and for generation of a relatively small amount of power, on the order of 200 MW. 9 figs.

26564 (PINSTECH/NED–130) **Isotopic composition of actinides and fission products in the irradiated fuel of the 10 MW low enriched PARR reference core.** Salahuddin, A.; Arshad, M. Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Nuclear Engineering Div. Oct 1987. 19p. English Order Number DE88706354/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the frame work of PARR core conversion from highly enriched uranium (HEU) to low enriched uranium (LEU) fuel and its power upgrading from 5 MW to 10 MW, isotopic compositions of actinides and fission products in the irradiated fuel of a 10 MW low enriched PARR reference core have been calculated. These calculations have been performed as a function of burning from 5 percent to 50 percent. 7 fig.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 26544, 26574, 26893

26565 (DPST–89-356) **Process water system integrity: A metallurgical evaluation.** Louthan, M.R. Jr. Savannah River Lab., Aiken, SC (USA). 10 Mar 1989. 7p. DOE Contract AC09-76SR00001. Order Number DE89010752/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This memorandum summarizes metallurgical data and analyses that demonstrate the continued reliability of the piping and components in the process water systems of SRP reactors. The principle structural materials in primary, D_2O, moderator/coolant pressure boundary are Type 304 and CF-8 austenitic stainless steels. These tough, weldable, corrosion resistant alloys are exposed to relatively pure moderator (pD 5.1, D_2O) at temperatures less than 100°C. The moderator pressure varies throughout the system but does not exceed the pump discharge pressure of 225 psig. Because of this low pressure, thermal and/or residual stresses in the pressure boundary steels typically exceed the applied stresses. Therefore, the stresses involved in environmental degradation of the steels are displacement controlled. Intergranular stress corrosion cracking, fatigue, transgranular stress corrosion cracking, and irradiation effects have been observed in the reactor system. The irradiation effects are limited to the reactor tank walls. A detailed description of the process water (coolant) system concludes "that the PCS has been adequately designed and is periodically tested and inspected to ensure that it can accomplish its intended function and maintain its integrity under the conditions imposed by postulated normal and accident conditions." This conclusion is consistent with the general observation that austenitic stainless steels have given excellent service in a wide variety of environments. 12 refs.

26566 (WHC-SP–0213) **Fracture mechanics calculations for hydrostatic testing of pressure tubes.** Riedel, E.E.; Johnson, K.I.; Simonen, F.A. Westinghouse Hanford Co., Richland, WA (USA). Jan 1988. 57p. DOE Contract AC06-87RL10930. Order Number DE89011036/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Assuring pressure tube integrity has been one of the primary missions of N Reactor surveillance and analysis efforts for many years. These efforts were intensified during the stand-down of CY 1987. The results of these efforts confirm a high-level of confidence in pressure tube integrity. Non-destructive examination (NDE) of the pressure tubes is a key element in the surveillance program. During each of the periodic NDE examinations, a fraction of the reactor's 1003 pressure tubes are inspected. While this effort is providing increased knowledge of pressure tube conditions, information about all pressure tubes is desired. Hydrostatic testing can be performed near the end of each major outage and provides additional proof of pressure tube integrity for all 1003 reactor tubes. This document discusses the magnitude of the safety margins provided by hydrostatic testing as well as potential limitations. It concludes that hydrostatic testing is beneficial and should be performed on a regular basis to provide added protection against pressure tube failures. 11 refs., 7 figs., 15 tabs.

2208 Propulsion Reactors

Refer also to citation(s) 26516, 26517, 26518

2209 Reactor Safety

Refer also to citation(s) 26389, 26390, 26396, 26481, 26483, 26484, 26485, 26487, 26489, 26490, 26510, 26515, 26520, 26528, 26530, 26542, 26543, 26546, 26547, 26548, 26549, 26550, 26551, 26552, 26554, 26555, 26556, 26566, 26733

26567 (CONF-881115–6) **Steam condensation on the underside of a horizontal surface.** Cho, D.H.; Stein, R.P. Argonne National Lab., IL (USA). 1988. 10p. DOE Contract W-31109-ENG-38. From 3. international topical meeting on nuclear power plant thermal hydraulics and operations; Seoul, KR; November 14, 1988. Order Number DE89009859/JAW. Available from NTIS, PC A02 - OSTI.

Experiments and data analysis for the condensation of steam on the underside of a horizontal surface in a closed vessel are described. Heat transfer measurements for condensation with air and helium as noncondensables are reviewed. Observations, including photographs of the condensate configurations, related to the occurrence of dropwise condensation are also discussed. It is noted that data reproducibility over long periods of time was possible only with film condensation and that with dropwise condensation condensing surface temperatures exhibited large nonuniformities and random fluctuations with time. The well known mass transfer calculational model for accounting for the presence of noncondensable gases was found to be reasonable with air. The same model when applied to the helium data was not successful except for small gas contents. It appears that the suppression of convection that would be expected to occur with the less dense gas is counteracted by convection induced by fog or mist formation. 20 refs., 11 figs.

26568 (CONF-890546–1) **Thermalhydraulic processes in the reactor coolant system of a BWR [boiling water reactor] under**

severe accident conditions. Hodge, S.A. Oak Ridge National Lab., TN (USA). 1989. 10p. DOE Contract AC05-84OR21400. From Seminar on fission product transport processes in reactor accidents; Dubrovnik, YU; May 22, 1989. Order Number DE89005338/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Boiling water reactors (BWRs) incorporate many unique structural features that make their expected response under accident conditions very different from that predicted in the case of pressurized water reactor accident sequences. Automatic main steam isolation valve (MSIV) closure as the vessel water level approaches the top of the core would cause reactor vessel isolation while automatic recirculation pump trip would limit the in-vessel flows to those characteristic of natural circulation (as disturbed by vessel relief valve actuation). This paper provides a brief discussion of the BWR control blade, channel box, core plate, control rod guide tube, and reactor vessel safety relief valve (SRV) configuration and the effects of these structural components upon thermalhydraulic processes within the reactor vessel under severe accident conditions. The dominant BWR severe accident sequences as determined by probabilistic risk assessment are briefly described and the expected timing of events for the unmitigated short-term station blackout severe accident sequence at the Peach Bottom Atomic Power Station is presented. 12 refs., 4 figs., 1 tab.

26569 (CONF-890546–2) **Phenomena occurring in the reactor coolant system during severe core damage accidents.** Malinauskas, A.P. Oak Ridge National Lab., TN (USA). 1989. 9p. DOE Contract AC05-84OR21400. From Seminar on fission product transport processes in reactor accidents; Dubrovnik, YU; May 22, 1989. Order Number DE89007206/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The reactor coolant system (RCS) of a nuclear power plant consists of the reactor pressure vessel and the piping and associated components that are required for the continuous circulation of the coolant which is used to maintain thermal equilibrium throughout the system. In the event of an accident, the RCS also serves as one of several barriers to the escape of radiotoxic material into the biosphere. In contrast to normal operating conditions, severe core damage accidents are characterized by significant temporal and spatial variations in heat and mass fluxes, and by eventual geometrical changes within the RCS. Furthermore, the difficulties in describing the system in the severe accident mode are compounded by the occurrence of chemical reactions. These reactions can influence both the thermal and the mass transport behavior of the system. In addition, behavior of the reactor vessel internals and of materials released from the core region (especially the radioactive fission products) in the course of the accident likewise become of concern to the analyst. This report addresses these concerns. 9 refs., 1 tab.

26570 (CONF-890546–4) **TRENDS [Transport and Retention of Nuclides in Dominant Sequences]: A code for modeling iodine behavior in containment during severe accidents.** Weber, C.F.; Beahm, E.C.; Kress, T.S.; Daish, S.R.; Shockley, W.E. Oak Ridge National Lab., TN (USA). 1989. 11p. DOE Contract AC05-84OR21400. From Seminar on fission product transport processes in reactor accidents; Dubrovnik, YU; May 22, 1989. Order Number DE89010377/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The ultimate aim of a description of iodine behavior in severe LWR accidents is a time-dependent accounting of iodine species released into containment and to the environment. Factors involved in the behavior of iodine can be conveniently divided into four general categories: (1) initial release into containment, (2) interaction of iodine species in containment not directly involving water pools, (3) interaction of iodine species in, or with, water pools, and (4) interaction with special systems such as ice condensers or gas treatment systems. To fill the large gaps in knowledge and to provide a means for assaying the iodine source term, this program has proceeded along two paths: (1) Experimental studies of the chemical behavior of iodine under containment conditions. (2) Development of TRENDS (Transport and Retention of Nuclides in Dominant Sequences), a computer code for modeling the behavior of iodine in containment and its release from containment. The main body of this report consists of a description of TRENDS. These two parts to the program are complementary in that models within TRENDS use data that were produced in the experimental program; therefore, these models are supported by experimental evidence that was obtained under conditions expected in severe accidents. 7 refs., 1 fig., 2 tabs.

26571 (CONF-8711245–6) **The integrated protection system: a software model for the Italian PWR-PUN simulator.** Giuli, G.; Mattucci, A.; Minichino, M.; Trani, M. ENEA Computer Programme Library, Ispra (Italy); Ansaldo S.p.A., Genoa (Italy). Nov 1987. 20p. From Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, IT; November 19, 1987. Order Number DE89770348/JAW. Available from NTIS (US Sales Only), PC A03.

Paper presented at ENEA-Halden reactor project workshop on computer applications for nuclear power and industrial process plant operation and control (Rome, 19-20 Nov 1987).

The Integrated Protection System (IPS) to perform the protective functions for the Italian pressurized water reactors is presented. The actual IPS functions and architecture are discussed in describing the overall IPS model design process for an engineering simulator of the PWR plants. The actual IPS functions are implemented by different processors acting in a completely asynchronous manner. The engineering simulator has one central processor, therefore, it must execute sequentially the IPS models. This makes it necessary to identify an IPS model architecture that takes into account the problem of implementing, on a sequential machine, the IPS asynchronous functions.

26572 (DOE/ID–10216-Vol.2) **Modifications of the development of the MAAP-DOE code: Volume 2, Steam generator modeling and benchmarking, Task 3.4.4.** Paik, C.Y. Fauske and Associates, Inc., Burr Ridge, IL (USA). Nov 1988. 104p. DOE Contract AC07-76ID01570. Order Number DE89009980/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A generalized theoretical model has been developed and numerically implemented to predict the thermal-hydraulic response of a U-tube steam generator during various transients such as steam line break, steam generator tube rupture, loss of feedwater, and primary side transients. A two-region model is used with a simple and fast running code to calculate essential state variables. Comparisons are made to the data of the Westinghouse Model Boiler 2 test for five types of transient. Good agreement is observed between the model predictions and the test data.

26573 (DOE/ID–10216-Vol.3) **Modifications for the development of the MAAP-DOE code: Volume 3, A mechanistic model for combustion in integrated accident analysis: Task 3.4.5.** Plys, M.G.; Astleford, R.D. Fauske and Associates, Inc., Burr Ridge, IL (USA). Nov 1988. 152p. DOE Contract AC07-76ID01570. Order Number DE89009981/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

A model for flammability characteristics and combustion of hydrogen and carbon monoxide mixtures is presented for application to severe accident analysis if advanced light water reactors (ALWRs). The purpose of the model development is to reduce uncertainty in the evaluation of fission product source terms for ALWRs through reduction in the uncertainty in phenomenological calculations. This is achieved because the model has a minimum number of adjustable parameters, and these parameters have a small range of variation. Background data on flammability and combustion are reviewed so that pertinent application can be made to the model. The mathematical formulation of the model is described and a driver program is demonstrated to be validated. The model is applied to four sets of recent hydrogen combustion experiments involving premixed combustion, injection conditions, quiescent and turbulent atmospheres, and inertants. These model benchmarks validate the model for the recommended model parameter values.

26574 (DP-MS–89-47) **Molten core–granitic concrete reaction studies at Savannah River.** Randolph, H.W.; Payne, J.E.; Margrave, J.L. Savannah River Lab., Aiken, SC (USA). 1989. 37p. DOE Contract AC09-76SR00001. (CONF-890378–7: American Nuclear Society workshop on safety of uranium-aluminum fueled reactors, Idaho Falls, ID, US, March 15, 1989). Order Number

DE89010473/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The production reactors at the Savannah River Plant are powered by uranium-aluminum alloy fuel cooled by flowing heavy water. As part of current severe accident consequence analysis, hypothetical cases of total loss of cooling are being evaluated. If there is such a loss of cooling in the main reactor tank, heat from radioactive fission product decay could cause the fuel to melt and penetrate the bottom of the reactor. Molten metal, called "corium" consisting of fuel, other core material, and part of the tank itself would then contact the concrete floor below the reactor and react chemically and physically to produce aerosols and other products. A study of the interactions of molten uranium-aluminum corium with granitic concrete has been established at Savannah River and experiments are being performed at the Savannah River Laboratory, the Houston Area Research Center and Rice University, and Sandia National Laboratories. The objective of the program is to gain an understanding of reactions to be expected when molten core material contacts granite aggregate concrete of the type under the reactors at the Savannah River Plant. Small scale (one to ten grams of metal) studies were designed to determine reaction chemistry when samples are heated with and without ionizing radiation. Larger scale studies with fifty to one hundred kilograms of metal were designed to gain an understanding of the physics, aerosol production and scale-up of processes.

26575 (EGG-M–02288) **RELAP5: Applications to high fidelity simulation.** Johnsen, G.W.; Chen, Y.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 8p. DOE Contract AC07-76ID01570. (CONF-8804263–1: Eastern simulation conference, Orlando, FL, US, April 22, 1988). Order Number DE89009665/JAW. Available from NTIS, PC A02 - OSTI.

RELAP5 is a pressurized water reactor system transient simulation code for use in nuclear power plant safety analysis. The latest version, MOD2, may be used to simulate and study a wide variety of abnormal events, including loss-of-coolant accidents, operational transients, and transients in which the entire secondary system must be modeled. In this paper, a basic overview of the code is given, its assessment and application illustrated, and progress toward its use as a high fidelity simulator described. 7 refs., 7 figs.

26576 (EPRI-NP–6304) **Seismic wave attenuation in eastern North America: Final report.** Gupta, I.N.; McLaughlin, K.L.; Wagner, R.A.; Jih, R.S.; McElfresh, T.W.; Schneider, J.F. (ed.). Electric Power Research Inst., Palo Alto, CA (USA); Teledyne Geotech, Alexandria, VA (USA). Apr 1989. 177p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report investigates frequency-dependent attenuation of vertical and horizontal components of ground motion in eastern North America (ENA). The data set consists of three-component, short-period recordings from 107 events (90 earthquakes and 17 explosions) at 57 (53 LRSM and 4 RSTN) stations. This represents a total of over 1300 seismograms from 454 event-station pairs with epicentral distances less than about 2000 km. We analyzed the frequency dependence of Q (Q(f)) over the frequency range 0.5 to 8 Hz using 5% damped response spectra of whole seismograms (including P, S and Lg) and narrow-bandpass filtered Lg phases. A multivariate, least-squares inversion program was then used to derive station and source terms and the path mean Q. The results of the general inversion for ENA are: Q values for the vertical and horizontal components are indistinguishable; there is a substantial increase in Q with frequency; there are large site terms for both the vertical and horizontal components; and the mean ratio of the peak horizontal (H) to peak vertical component (Z), or H/Z, is a stable characteristic of a site. In general, H/Z is significantly larger for sediment than for basement/crystalline rock sites. Using bandpass filtered Lg phases from 1 to 7 Hz, we estimated regionalized values of Q(f). ENA was subdivided into 10 distinct regions on the basis of geological and geophysical data. Large variations were found, with higher Q values predominating in the shield and Grenville Province of southeastern Canada and in Appalachia. The lowest Q values predominate in the Mississippi embayment and Gulf coastal plain. Finally, we obtained a good correlation for a comparison of zones of modified Mercalli (MM) intensity from the 1886 Charleston, South Carolina earthquake with site terms derived from stations used in this study. 72 refs., 69 figs., 9 tabs.

26577 (HEDL–7658) **The Fast Flux Test Facility built on safety.** Hanford Engineering Development Lab., Richland, WA (USA). [1989]. 20p. DOE Contract AC06-76FF02170. Order Number DE89010165/JAW. Available from NTIS, PC A03 - OSTI.

No other high-tech industry has grown as fast as the nuclear industry. The information available to the general public has not kept pace with the rapid growth of nuclear data—its growth has outpaced its media image and the safety of nuclear facilities has become a highly debated issue. This book is an attempt to bridge the gap between the high-tech information of the nuclear industry and its understanding by the general public. It explains the three levels of defense at the Fast Flux Test Facility (FFTF) and why these levels provide an acceptable margin to protect the general public and on-site personnel, while achieving FFTF's mission to provide research and development for the US Department of Energy (DOE).

26578 (HEDL-SA–3651) **Safety analysis of FFTF loss of flow without scram tests.** Van Keuren, J.C.; Heard, F.J.; Stepnewski, D.D. Hanford Engineering Development Lab., Richland, WA (USA). Dec 1986. 23p. DOE Contract AC06-76FF02170. (CONF-870601–24: Annual meeting of the American Nuclear Society, Dallas, TX, US, June 7, 1987). Order Number DE89010132/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Loss of flow without scram tests were conducted at the Fast Flux Test Facility (FFTF) in July of 1986 as part of the passive safety program. This paper describes the safety analyses that were conducted in preparation for these tests. The next two papers in this session will report results of the testing and give more details. These tests involved shutting off primary coolant flow with the reactor at powers of up to 200 MW or 50% of normal full power. PPS trips were bypassed prior to the test and additional trips installed. Consequently, a detailed reevaluation of PPS system and its response to off-normal events was required.

26579 (HEDL-SA–3717) **FFTF [Fast Flux Test Facility] performance measurements for safety, productivity and control.** Newland, D.J.; Praetorius, P.R.; Tomaszewski, T.A. Hanford Engineering Development Lab., Richland, WA (USA). May 1987. 10p. DOE Contract AC06-87RL10930. (CONF-870917–12: ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation, Richland, WA, US, September 13, 1987). Order Number DE89010134/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A useful set of performance measurements for Safety, Productivity and Control has evolved at the Fast Flux Test Facility (FFTF). In response to declining budgets and the resulting need to safely manage a manpower rampdown, an "Early Warning System" was developed in 1984. Its purpose was to monitor the effects of the staffing rampdown such that appropriate remedial action could be taken to correct adverse trends before a significant problem occurred. 1 tab.

26580 (Juel-Spez–469) **Flow and gas exchange processes after leaks in the primary circuit of high temperature reactors.** Breitbach, G.; David, H.P.; Nickel, M.; Wolters, J. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung. Oct 1988. 34p. (In German). Order Number DE89764711/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The occurrence of leaks in the pressurized enclosure of an Helium cooled High Temperature Reactor (HTR module) leads in a first step to a rapid outflow of the cooling gas. After loss of pressure gas exchange processes start governed by convection, diffusion and the so called 'breathing' of the primary circuit. Theoretical models for the treatment of the processes are presented. Further experimental investigations are reported. The phenomena are discussed and theory and experiments are compared.

26581 (KFKI–1988-63/G) **Experimental investigation of core cooling at different coolant levels in the core.** Bandurski, Th.; Ezsoel, Gy.; Maroti, L.; Toth, I. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1988.

58p. (In Hungarian). Order Number DE89610830/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

If a small diameter pipe rupture occurs in the primary coolant circuit of a nuclear power plant, the level of coolant is reduced uniformly during the failure without any significant dynamical influences. Two series of experiments were performed in a test facility PMK-NVH located in CRIP, Hungary, to clarify the consequences of pipe rupture in the reactor core. These experiments were performed under quasi stationary conditions. The experimental conditions, two experimental series, and the results of the analysis are described in detail. (R.P.) 8 refs.; 30 figs.; 1 tab.

26582 (KFKI–1988-65/G) **RELAP5 - a new tool for pressurized water reactor safety analysis.** Perneczky, L. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1988. 26p. (In Hungarian). Order Number DE89610855/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The RELAP type pressurized water reactor safety system codes are used world wide for the loss of coolant accident analyses. In this paper the RELAP5, the advanced generation of the code family is presented. The relationship to RELAP4/mod6 version is discussed. The capability of the RELAP5/mod1-EUR version for small, medium and large break LOCA is investigated based on international user experience. (author) 30 refs.

26583 (NUREG–1137-Suppl.9) **Safety evaluation report related to the operation of Vogtle Electric Generating Plant, Units 1 and 2 (Docket Nos. 50-424 and 50-425).** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Mar 1989. 23p. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

In June 1985, the staff of the Nuclear Regulatory Commission issued its Safety Evaluation Report (NUREG-1137) regarding the application of Georgia Power Company, Municipal Electric Authority of Georgia, Oglethorpe Power Corporation, and the City of Dalton, Georgia, for licenses to operate the Vogtle Electric Generating Plant, Units 1 and 2 (Docket Nos. 50-424 and 50-425). Supplement 1 to NUREG-1137 was issued by the staff in October 1985, Supplement 2 was issued in May 1986, Supplement 3 was issued in August 1986, Supplement 4 was issued in December 1986, Supplement 5 was issued in January 1987, Supplement 6 was issued in March 1987, Supplement 7 was issued in January 1988, and Supplement 8 was issued in February 1989. The facility is located in Burke County, Georgia, approximately 26 miles south-southeast of Augusta, Georgia, and on the Savannah River. This ninth supplement to NUREG-1137 provides recent information regarding resolution of conditional items following issuance of Supplement 8.

26584 (NUREG–1232-Vol.3) **Safety Evaluation Report on Tennessee Valley Authority: Browns Ferry Nuclear Performance Plan: Browns Ferry Unit 2 restart.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Apr 1989. 80p. Available from NTIS, PC A05/MF A01 - GPO - OSTI.

This safety evaluation report (SER) on the information submitted by the Tennessee Valley Authority (TVA) in its Nuclear Performance Plan, through Revision 2, for the Browns Ferry Nuclear Power Station and in supporting documents has been prepared by the US Nuclear Regulatory Commission staff. The plan addresses the plant-specific concerns requiring resolution before startup of Unit 2. The staff will inspect implementation of those programs. Where systems are common to Units 1 and 2 or to Units 2 and 3, the staff safety evaluations of those systems are included herein. 3 refs.

26585 (NUREG–1275-Vol.5) **Operating experience feedback report: Progress in scram reduction: Commercial power reactors.** Bell, L.G.; O'Reilly, P.D. Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data. Mar 1989. 299p. Available from NTIS, PC A13/MF A01 - GPO - OSTI.

This report documents the results of a trends and patterns analysis of unplanned reactor scrams at commercial US nuclear power reactors from January 1, 1984 to January 1, 1988. Major objectives of this report prepared by the Nuclear Regulatory Commission's (NRC's) Office for Analysis and Evaluation of Operational Data (AEOD) are to: (1) provide feedback of operational experience regarding reactor scram trends in support of the Commission's Strategic Goals, (2) examine the causes of unplanned scrams, and (3) examine the relationship between the causes of unplanned scrams and industry initiatives undertaken to reduce the frequency of unplanned scrams, especially with a view to the potential for future scram rate reduction. 31 refs., 14 figs., 49 tabs.

26586 (NUREG–1348) **Report on the visit of a U.S. Nuclear Safety Delegation to the Soviet Union, August 19-31, 1988.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Governmental and Public Affairs. Mar 1989. 101p. Available from NTIS, PC A06/MF A01 - GPO - OSTI.

During August 1988 a US delegation of nuclear reactor safety specialists, led by US Nuclear Regulatory Commission Chairman Lando W. Zech, Jr., visited the Soviet Union to initiate cooperative activities in civilian nuclear reactor safety between the two countries under their April 1988 Memorandum of Cooperation. Areas of future cooperation and a schedule of working group meetings to explore these areas were defined in a protocol signed during this visit. The delegation met with Soviet representatives in Moscow as the Joint coordinating Committee on Civilian Nuclear Reactor Safety. Additionally, while in Moscow, Chairman Zech held discussions with leaders and other senior officials of Soviet organizations with responsibility for nuclear power safety. Nuclear facilities were also visited, including the Kurchatov Institute of Atomic Energy (Moscow), the Novovoronezh Atomic Power Station, the Novovoronezh Training and Commissioning Center, the Izhora Heavy Equipment Production Plant (Kolpino), the V. G. Khlopin Radium Institute (Gatchina), the Chernobyl Atomic Power Station, the All-Union Center for Radiation Medicine (Kiev), and the Rovno Atomic Power Station. 35 figs.

26587 (NUREG/CP–0097-Vol.2) **Sixteenth water reactor safety information meeting: Proceedings.** Weiss, A.J. (comp.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA). Mar 1989. 399p. DOE Contract AC02-76CH00016. (CONF-8810155–Vol.2: 16. water reactor safety information meeting, Gaithersburg, MD, US, October 24, 1988). Available from NTIS, PC A17/MF A01 - GPO - OSTI.

This five-volume report contains 141 papers out of the 175 that were presented at the Sixteenth Water Reactor Safety Information Meeting held at the National Institute of Standards and Technology, Gaithersburg, Maryland, during the week of October 24–27, 1988. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the meeting included twenty different papers presented by researchers from Germany, Italy, Japan, Sweden, Switzerland, Taiwan and the United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting. This document, Volume 2, discusses industry safety research, nondestructive evaluation, and materials engineering.

26588 (NUREG/CP–0097-Vol.3) **Sixteenth water reactor safety information meeting: Proceedings: Volume 3, Nuclear plant aging, structural and seismic engineering, mechanical research, environmental effects in primary systems.** Weiss, A.J. (comp.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA). Mar 1989. 564p. DOE Contract AC02-76CH00016. (CONF-8810155–Vol.3: 16. water reactor safety information meeting, Gaithersburg, MD, US, October 24, 1988). Available from NTIS, PC A24/MF A01 - GPO - OSTI.

This five-volume report contains 141 papers out of the 175 that were presented at the Sixteenth Water Reactor Safety Information Meeting held at the National Institute of Standards and Technology, Gaithersburg, Maryland, during the week of October 24-27, 1988. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the melting included twenty different papers presented by reseachers from Germany, Italy, Japan, Sweden, Switzerland, Taiwan and the United Kingdom. The titles of the papers and the

names of the authors have been updated and may differ from those that appeared in the final program of the meeting.

26589 (NUREG/CP–0097-Vol.4) **Sixteenth water reactor safety information meeting: Proceedings: Volume 4, Code uncertainty for ECCS rule; international code assessment program; thermal hydraulics; 2D/3D data applications.** Weiss, A.J. (comp.). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA). Mar 1989. 617p. DOE Contract AC02-76CH00016. (CONF-8810155–Vol.4: 16. water reactor safety information meeting, Gaithersburg, MD, US, October 24, 1988). Available from NTIS, PC A99/MF A01 - GPO - OSTI.

This five-volume report contains 141 papers out of the 175 that were presented at the Sixteenth Water Reactor Safety Information Meeting held at the National Institute of Standards and Technology, Gaithersburg, Maryland, during the week of October 24-27, 1988. The papers are printed in the order of their presentation in each session and describe progress and results of programs in nuclear safety research conducted in this country and abroad. Foreign participation in the meeting included twenty different papers presented by researchers from Germany, Italy, Japan, Sweden, Switzerland, Taiwan and the United Kingdom. The titles of the papers and the names of the authors have been updated and may differ from those that appeared in the final program of the meeting.

26590 (NUREG/CR–5124) **Interfacing systems LOCA: Boiling water reactors.** Chu, T-L.; Stoyanov, S.; Fitzpatrick, R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; Brookhaven National Lab., Upton, NY (USA). Feb 1989. 328p. DOE Contract AC02-76CH00016. (BNL-NUREG–52141). Available from NTIS, PC A15/MF A01 - GPO - OSTI.

This report summarizes a study performed by Brookhaven National Laboratory for the Office of Regulatory Research, Reactor and Plant Safety Issues Branch, Division of Reactor and Plant Systems, US Nuclear Regulatory Commission. This study was requested by the NRC in order to provide a technical basis for the resolution of Generic Issue 105, "Interfacing LOCA at LWRs."This report deals with boiling water reactors (BWRs). A parallel report was also accomplished for pressurized water reactors. This study focusses on three representative BWRs and extrapolates the plant-specific findings for their generic applicability. In addition, a generic analysis was performed to investigate the cost-benefit aspects of imposing a testing program that would require some minimum level of leak testing of the pressure isolation valves on plants that presently have no such requirements.

26591 (NUREG/CR–5261) **Safety evaluation of MHTGR licensing basis accident scenarios.** Kroeger, P.G. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (USA). Apr 1989. 106p. DOE Contract AC02-76CH00016. (BNL-NUREG–52174). Available from NTIS, PC A06/MF A01 - GPO - OSTI.

The safety potential of the Modular High-Temperature Gas Reactor (MHTGR) was evaluated, based on the Preliminary Safety Information Document (PSID), as submitted by the US Department of Energy to the US Nuclear Regulatory Commission. The relevant reactor safety codes were extended for this purpose and applied to this new reactor concept, searching primarily for potential accident scenarios that might lead to fuel failures due to excessive core temperatures and/or to vessel damage, due to excessive vessel temperatures. The design basis accident scenario leading to the highest vessel temperatures is the depressurized core heatup scenario without any forced cooling and with decay heat rejection to the passive Reactor Cavity Cooling System (RCCS). This scenario was evaluated, including numerous parametric variations of input parameters, like material properties and decay heat. It was found that significant safety margins exist, but that high confidence levels in the core effective thermal conductivity, the reactor vessel and RCCS thermal emissivities and the decay heat function are required to maintain this safety margin. Severe accident extensions of this depressurized core heatup scenario included the cases of complete RCCS failure, cases of massive air ingress, core heatup without scram and cases of degraded RCCS performance due to absorbing gases in the reactor cavity. Except for no-scram scenarios extending beyond 100 hr, the fuel never reached the limiting temperature of 1600°C, below which measurable fuel failures are not expected. In some of the scenarios, excessive vessel and concrete temperatures could lead to investment losses but are not expected to lead to any source term beyond that from the circulating inventory. 19 refs., 56 figs., 11 tabs.

26592 (NUREG/CR–5355) **HTGR [High Temperature Gas-Cooled Reactor] ingress analysis using MINET.** Van Tuyle, G.J.; Yang, J.W.; Kroeger, P.G.; Mallen, A.N.; Aronson, A.L. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (USA). Apr 1989. 60p. DOE Contract AC02-76CH00016. (BNL-NUREG–52193). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

Modeling of water/steam ingress into the primary (helium) cooling circuit of a High Temperature Gas-Cooled Reactor (HTGR) is described. This modeling was implemented in the MINET Code, which is a program for analyzing transients in intricate fluid flow and heat transfer networks. Results from the simulation of a water ingress event postulated for the Modular HTGR are discussed. 27 refs., 6 figs., 6 tabs.

26593 (SAND–88-1746C) **Overview of programs at Sandia National Laboratories.** von Riesemann, W.A. Sandia National Labs., Albuquerque, NM (USA). 1988. 11p. DOE Contract AC04-76DP00789. (CONF-890561–2: American Society of Civil Engineers (ASCE) structures conference, San Francisco, CA, US, May 1, 1989). Order Number DE89002893/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of the Sandia program is to provide the NRC with a suite of validated methods that can be used to predict the response of the containment structure and its penetrations when subjected to severe accidents. The development of the pressure and temperature loadings for various severe accident scenarios will not be discussed in this paper. 18 refs.

26594 (WHC-SA–0046) **Passive safety testing at the Fast Flux Test Facility.** Lucoff, D.M. Westinghouse Hanford Co., Richland, WA (USA). Sep 1987. 21p. DOE Contract AC06-87RL10930. (CONF-870917–11: ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation, Richland, WA, US, September 13, 1987). Order Number DE89010116/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The design and licensing of a passively safe LMR, requires that reactor feedback mechanisms be thoroughly understood over the entire range of core conditions relevant to any transient event. While experience with LMRs has provided a solid basis for understanding core reactivity feedback coefficients over the normal range of core conditions, few experiments have been conducted to explore the full range of thermal-hydraulic conditions associated with unprotected transients or so-called ATWS (Anticipated Transients Without Scram) events. Testing is being performed at the Fast Flux Test Facility (FFTF). The FFTF is a full size core operating at a power of 400 MWt with provisions for in-bundle temperature measurements. The FFTF is operated for the Department of Energy by the Westinghouse Hanford Company. The FFTF Passive Safety Testing Program began two years ago. The program has two near-term objectives: (1) to extending passive safety testing experience to a large size LMR to improve design analysis computer codes, e.g., SASSYS, and (2) to develop and test passive safety enhancements that could be used for future LMRs. In addition, the FFTF program has a third, follow-on, objective to develop Technical Specification Surveillance to confirm that actual core reactivity feedback behavior assures predicted performance in the event of an off-normal transient. 1 ref., 6 figs.

26595 Post-implementation review of inadequate core cooling instrumentation. Anderson, J.L. (Oak Ridge National Lab., Oak Ridge, TN (US)); Anderson, R.L.; Hagen, E.W.; Morelock, T.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA)*, 36(1): 1248-1250 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Studies of the Three Mile Island (TMI) accident identified the need for additional instrumentation to detect inadequate core cooling (ICC) in nuclear power plants. NRC Regulatory Guide 1.97,

which covers accident monitoring instrumentation, was revised to be consistent with the requirements of item II.F.2 of NUREG-0737. Following are some of the more significant requirements specified in that item. Instrumentation should provide an unambiguous indication of the approach to and existence of ICC. Reactor water level measurement is to be considered. The system must indicate the existence of ICC caused by various phenomena (e.g., high void fraction pumped flow and stagnant boil-off). The presence of an unrelated phenomenon must not cause the system to erroneously indicate ICC. Advance warning of the approach of ICC must be given. Instrumentation must conform to Appendix B (Class 1E) of NUREG-0737. Alarms and displays should be selected based on a human factors analysis. Instrumentation indications must be integrated into emergency procedures and operator training programs.

25 ENERGY STORAGE

Refer also to citation(s) 26647

2509 Batteries

Refer also to citation(s) 26717, 26718, 26800

26596 (AD-A-203071/6/XAB) **Chemical and electrochemical properties of potential battery systems in room-temperature molten salts. Final report, 1984-1987.** Donahue, F.M.; Simonsen, L.; Moy, R.; Borns, S. Michigan Univ., Ann Arbor, MI (USA). Dept. of Chemical Engineering. 25 Oct 1988. 66p. Available from NTIS, PC A04/MF A01.

Aluminum electrodes were studied in basic and acidic melts. Dissolution was possible in both environments, but deposition was possible only in acidic melts. Extensive studies in acidic melts indicated that the exchange current density was relatively low (even at approx. 100C, it was approx. 1 mA/sq. cm) and that some passivation occurred at high current densities/overpotentials. However, the dissolution behavior at moderate rates (< or = mA/sq. cm) indicated relatively low polarization (sufficient for battery applications).

26597 **Membrane reference electrode.** Redey, L.; Bloom, I.D. To Dept. of Energy. USA Patent Application 7-147,825. 21 Jan 1988. 14p. DOE Contract W-31109-ENG-38. Order Number DE89010896/JAW. Available from NTIS, PC A03 - OSTI.

A reference electrode utilizes a small thin, flat membrane of a highly conductive glass placed on a small diameter insulator tube having a reference material inside in contact with an internal voltage lead. When the sensor is placed in a non-aqueous ionic electrolytic solution, the concentration difference across the glass membrane generates a low voltage signal in precise relationship to the concentration of the species to be measured, with high spatial resolution. 2 figs.

26598 **Novel air electrode for metal-air battery with new carbon material and method of making same.** Ross, P.N. Jr. To Dept. of Energy. USA Patent Application 7-209,397. 21 Jun 1988. 18p. DOE Contract AC03-76SF00098. Order Number DE89010964/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This invention relates to a rechargeable battery or fuel cell. More particularly, this invention relates to a novel air electrode comprising a new carbon electrode support material and a method of making same. 3 figs.

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis and Modeling

Refer also to citation(s) 26626

26599 (EMR–1981) **Canadian energy system supply and demand sensitivity studies. Vol. 2. Energy supply and utilization tables.** Teichmann, T. Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). 1981. 51p. (CE–02102). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Tables of computed data are presented which result from a computer simulation of Canadian energy supply and utilization under various scenarios, at 5-year intervals from 1980 to 2010. Tables are in three parts: fossil fuel balance, with data on supply (according to source) and utilization (according to end use); non-fossil supply and utilization, including new electric capacity, renewables, and other sources such as hydrogen; and annual undiscounted costs. Scenarios include the base case, reduced demand, enhanced conservation, and various degrees of reduction in use of nuclear, coal, tar sands, and gas utilization. 26 tabs.

26600 (INIS-mf–11934) **Conditions and impacts of a nuclear power plant shut-off on the electricity supply situation in Hamburg.** Goy, G.C.; Ziesing, H.J.; Angerer, G.; Schoen, M. Deutsches Inst. fuer Wirtschaftsforschung, Berlin (Germany, F.R.); Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Freie und Hansestadt Hamburg (Germany, F.R.). Jul 1988. 421p. (In German). Order Number DE89764534/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

Short version published in separate volume.

The expert opinion is arranged in eight chapters. The first chapter presents a survey of the development of quantities and patterns of electricity consumption in Hamburg since the beginning of the 1970s, the second chapter discusses the demographic and economic data to be used for a forecast of electricity demand in Hamburg, and the weighting of data. Assessments of changes in energy costs in the future are explained in this framework, with special emphasis on the probable movements in prices in the power plant sector, which are a prime factor in assessing the economic impact of a nuclear power plant shut-off. The third chapter discusses future trends in electricity consumption, whereas the fourth chapter deals with the possibilities and means available and required for satisfying the demand for electricity without the nuclear energy source. The fifth chapter explains the economic situation of the HEW utility (Hamburger Elektrizitaets-Werke AG) as a result of a complete nuclear shut-off, and the sixth investigates the economic impacts on the electricity consumers. The seventh chapter is devoted to the ecologic situation created by a nuclear power plant shut-off, presenting data on expected pollutant emission and the waste to cope with, emanating from fossil fueled and nuclear power plant. The concluding chapter summarizes the given scenarios into an action program for preparing and improving the conditions and prerequisites in allowing a nuclear power plant shut-off, taking into account the scope of action of Hamburg local government.

2902 Economics and Sociology

Refer also to citation(s) 26452, 26611, 26615, 26625, 26638, 26639, 26640, 26641, 26643, 26659, 26714

26601 (MEM–1988) **Manitoba Energy and Mines annual report, 1987-88.** Manitoba Ministry of Energy and Mines, Winnipeg, MB (Canada). [1988]. 47p. (MICROLOG–89-01673). Available from Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The medium- and long-term direction of the Department of Energy and Mines, in addressing its mandate, is to ensure continuity and enhancement of future benefits from Manitoba's mineral and energy resources. During the year, these functions were carried out by four main divisions: Energy Management; Minerals; Petroleum; and Policy, Planning and Project Development, with support from the Financial and Administrative Services Division, and the Communications and Community Relations Division. The Department also has responsibility for the Oil and Natural Gas Conservation Board, and the Manitoba Energy Council, plus a number of other crown corporations and boards who issue their own separate reports. A summary of expenditures of the Department for the year is given, and the activities of the divisions and associated boards and councils are described. These include energy conservation programs for

the residential, commercial, agricultural, and industrial sectors; renewable and alternative energy projects; geological exploration and research; mining and petroleum industry activities and programs; and energy and resource policy, planning and project development. 4 figs., 15 tabs.

26602 (NSAEC–8809) **Cost of fuel and utilities Newfoundland and Labrador, 1988.** Newfoundland Statistics Agency Executive Council (Canada). 1988. 81p. (MICROLOG–89-01683). Available from Newfoundland Statistics Agency, Executive Council, Confederation Bldg., St John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This latest survey of fuel and utility consumer prices was conducted during the period of May 23-27, 1988. Retail prices in a number of Newfoundland and Labrador communities were collected for furnace oil and stove oil, regular leaded and regular unleaded gasoline, diesel fuel oil and electricity. The survey also compares petroleum product prices and electricity rates throughout the province for May, 1988 with those in May, 1987. The historical supplement shows how prices have moved since the survey started in 1975. Also included are price comparisons of some fuels in the major cities of Canada. The results of this year's survey indicate that the average price of most petroleum products in the province have remained relatively stable for the period. The average price of furnace oil was 32.5 cent/l, an increase of 0.6% from the previous year. The average price of stove oil was $0.351/l, an increase of 0.3% from the previous year. 6 figs., 43 tabs.

26603 (OY/PSTL-RR–83) **Large-scale resource development in a rural community. The case of Haapavesi peat-fired power station.** Kiukaanniemi, E.; Joutsenoja, M. Oulu Univ. (Finland). Research Inst. of Northern Finland. 1988. 43p. (In Finnish). Order Number DE88757319/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

This case study deals with the effects of an extensive production investment in an economically remote area on its immediate surroundings, i.e. economic repercussions of the peat-fired power plant being built in Haapavesi. The construction of the power station involved a major adaptation problem for the target area. Some 40% of the workforce in 1987 was recruited from the local administrative district, and at the same time thirty new companies were founded, mainly in the service sector. The estimated impact of the future operational phase was assessed using a Keynesian income multiplier model. The estimated effects of the early operational phase in 1991 were calculated to be 262 new jobs in Haapavesi, an increase of 25.6 million FIM in personal incomes and an increase of 4.5 million FIM in local government tax revenues. (20 refs).

2903 Environment, Health, and Safety

Refer also to citation(s) 26397, 26626, 26627, 26628, 26668, 26705, 27074, 27104, 27131, 27132, 27133, 27134, 27143, 27144, 27144, 27145, 27165, 27166, 27167, 27168, 27171, 27172, 27173, 27174, 27175

26604 (ESC-WR–89-04) **Energy and environment. Single-country report Netherlands.** Van Oostvoorn, F.; Gerbers, D.; Tiemersma, D.N. Stichting Energieonderzoek Centrum Nederland, Petten (Netherlands). Energie Studie Centrum. Mar 1989. 43p. Available from Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

This report covers the Dutch contribution to the EC study 'Energy and environment', which is executed by the Energy Study Centre of the Netherlands Energy Research Foundation for DG 12. It contains analyses and estimates of SO_2- and NO_x-emissions and costs of abatement policies in relation with energy demand and supply. The study concerns data collection, model adaptation and execution of model runs with the dynamic LP model EFOM to evaluate emissions and environmental compliance costs for different abatement scenarios in the Netherlands. The following subjects are discussed: the environmental situation; model modifications, to improve the applicability of the model EFOM for the Netherlands; the abatement scenarios. The economic framework and energy demand are briefly reviewed and the scenario results are presented. Finally conclusions are stated. 11 figs., 5 refs., 6 tabs., 2 apps.

26605 (PB–89-143291/XAB) **National Toxicology Program: review of current DHHS (Department of Health and Human Services), DOE (Department of Energy), and EPA (Environmental Protection Agency) research related to toxicology, Fiscal Year 1988. Annual report.** National Toxicology Program, Research Triangle Park, NC (USA). Jun 1988. 382p. (NTP–88-201). Available from NTIS, PC A17/MF A01.

See also report for Fiscal Year 1987, PB–88-131750.

The publication lists chemicals being studied by various DHHS agencies, the Department of Energy, and the Environmental Protection Agency, and describes toxicology research and toxicology methods currently being developed by these agencies for FY 1988. The NTP coordinates selected toxicology activities of the National Institute of Environmental Health Sciences, National Institutes of Health; the National Center for Toxicological Research, Food and Drug Administration; and the National Institute for Occupational Safety and Health, Centers for Disease Control.

26606 (PB–89-154116/XAB) **Assessing contractor use in Superfund. A background paper of OTA's (Office of Technology Assessment) assessment on Superfund implementation.** Office of Technology Assessment (U.S. Congress), Washington, DC (USA). Jan 1989. 50p. Available from NTIS, PC A03/MF A01.

See also PB–83-189241.

This background paper describes how the Superfund program uses contractors, and how their role is related to that of the Environmental Protection Agency's staff. OTA discusses the history and extent of contractor use in Superfund and explains why the original reasons for EPA's heavy dependence on contractors may no longer be valid. Also included are some ideas for improving the environmental performance and economic efficiency of Superfund over the long term.

26607 (PB–89-165211/XAB) **Hazard-evaluation and technical-assistance report No. TA-76-91, Front Royal and Panorama Entrance Stations, Shenandoah National Park, Luray, Virginia.** Haas, B.H.; Geissert, J.O. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Nov 1976. 15p. (NIOSH/TA–76-091). Available from NTIS, PC A03/MF A01.

A study was made of possible hazardous working conditions at the Panorama and Front Royal Entrance Stations at Shenandoah National Park located in Luray, Virginia. Specifically, possible exposures to sulfur dioxide, lead, and carbon monoxide emitted from cars being assisted at the entrance stations, which resemble toll booths, were to be evaluated. Of 11 analyses taken, five exceeded or were very near the 5% limit of carboxyhemoglobin recommended by NIOSH; five also ranged from half to over the recommended level of 1 mg/m3 for sulfuric-acid. Sulfur-dioxide and lead exposures were all nonsignificant. All the rangers suffered excessive exposures to carbon-monoxide. The authors recommend that changes be made to reduce these exposures. The rangers could work in the booths for a shorter portion of the day, alternating with park rangers who perform other duties. Both booths could be operated at each station, thus reducing the amount to which each ranger was exposed. The installation of positive pressure ventilation should be the main approach and is likely to be the only one which will significantly alleviate the problem.

26608 (PB–89-166375/XAB) **Unfinished business in New England: a comparative assessment of environmental problems. Overview report. Final report.** Environmental Protection Agency, Boston, MA (USA). Region I. Dec 1988. 64p. (EPA–901/7-89/001). Available from NTIS, PC A04/MF A01.

See also PB–89-166383.

This report presents the results of a study conducted by EPA in New England that examined 24 environmental problems and assessed the level of residual risk posed by each problem to human health and to ecosystems. Residual risk is defined as the risk posed by a problem, given current levels of control. The authors also estimated the management tools that are currently available to address the highest risk problem areas. The report summarizes the methodology that was used to conduct these analyses, the findings of the

study and lessons learned. The three problems posing the most-serious residual risk for human health are ozone, radon and lead. The problems posing the most serious ecological risks are air pollution (primarily ozone), acid rain, loss of wetlands and habitat, all discharges to surface water, and accidental releases.

26609 (PB–89-166383/XAB) **Unfinished business in New England: a comparative assessment of environmental problems. Public Health Risk Work Group Report. Final report.** Environmental Protection Agency, Boston, MA (USA). Region I. Dec 1988. 134p. (EPA–901/7-89/002). Available from NTIS, PC A07/MF A01.

See also PB–89-166375.

This report presents the results of a study undertaken by EPA in New England that examined 24 environmental problems and assessed the level of residual risk posed by each problem to human health. Using the methodological framework of risk assessment, the Public Health Work Group developed estimates of residual risk for individuals and populations for each of the problem areas. Residual risk is defined as the risk posed by a problem, given current levels of control. Analyses for cancer risk and non-cancer risk were developed independently and then combined at the end of the study to produce a single ranking.

26610 (PB–89-166391/XAB) **Unfinished business in New England: a comparative assessment of environmental problems. Ecological Risk Work Group Report. Final report.** Environmental Protection Agency, Boston, MA (USA). Region I. Dec 1988. 115p. (EPA–901/7-89/003). Available from NTIS, PC A06/MF A01.

See also PB–89-166383.

This report presents the results of a study undertaken by EPA in New England that examined 24 environmental problems to determine which areas present the greatest residual ecological risk. The analyses conducted by the Ecological Risk Work Group compared the stressors associated with each problem area with eight different ecosystems found in New England. The group found that the problems posing the most serious ecological risks are air pollution (particularly ozone), acid rain, loss of wetlands and habitat, all discharges to surface water, and accidental releases.

26611 (PB–89-859144/XAB) **Pollution liability insurance: availability, demand, and coverage. January 1985-March 1989 (Citations from the Biobusiness data base). Report for January 1985-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 51p. Available from NTIS PC N01/MF N01.

This bibliography contains citations concerning pollution liability insurance availability, demand, and coverage. Topics include the reduced availability of pollution liability insurance, the increased demand for this insurance, and the impact of Superfund decisions on pollution liability insurance claims. Court cases to determine whether the polluting company or the insurance company is responsible for hazardous materials cleanup are cited. Requirements for self insurance and elimination of the requirement for hazardous waste clean-up companies to be insured by a third company are included. (Contains 96 citations fully indexed and including a title list.)

26612 (WHC-EP–0219) **Environmental Information Management Plan.** Steward, J.C.; Main, G.C.; See, E.J. Westinghouse Hanford Co., Richland, WA (USA). Mar 1989. 90p. DOE Contract AC06-87RL10930. Order Number DE89011103/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Environmental Information Management Plan provides an overview of the integrated approach to managing the Hanford Site environmental data. The Environmental Data Management Center has been established to ensure that all environmental information is retrievable throughout the lifetime of the environmental programs. Part I of this Environmental Information Management Plan addresses the methods by which environmental information is processed into a working file management system with an emphasis on retrievability. File categories have been established to accommodate compilation of Administrative Records and to provide a central reference file location for all environmental information. The Environmental Data Management Center coordinates the Administrative Record activities, ensuring distribution of Administrative Record Indices and Administrative Record documents to the US Environmental Protection Agency, Washington Department of Ecology, and four information repositories. Part II addresses the long-range plan for management of scientific and technical environmental data. The planning and control activities affecting data are discussed. These activities include data collection, analysis, integration, transfer, storage, retrieval, and presentation. The tasks described in Part II will result in definition of policies, procedural systems, and automation components necessary to ensure that environmental data are accessible, traceable, and sufficiently qualified to meet future needs. 4 figs., 9 tabs.

2904 Natural Resources

Refer also to citation(s) 26601, 26705, 27169, 27170

26613 (PB–89-148423/XAB) **Columbium-, rare-earth-element-, and thorium-bearing veins near Salmon Bay, Southeastern Alaska. Open file report.** Warner, J.D. Bureau of Mines, Fairbanks, AK (USA). Alaska Field Operations Center. Jan 1989. 31p. (BUMINES-OFR–06-89). Available from NTIS, PC A03/MF A01.

In 1984 and 1985 the Bureau of Mines investigated radioactive carbonate veins near Salmon Bay, southeastern Alaska, for concentrations of columbium and associated metals. The veins cut units of graywacke, conglomerate, argillite, and limestone and range in width from less than an inch to greater than 10 ft and have a length ranging from less than a hundred to greater than 1,000 ft. Mineralogy of the veins is complex, and includes thorite, the rare-earth-element minerals monazite, parisite, and bastnaesite, and a columbium mineral that is speculated to be columbite. Gangue minerals include ankerite, dolomite, siderite, quartz and albite. More than seventy veins were sampled but only three contain elevated metal concentrations along a significant strike length. These resources are small compared to columbium, REE, and thorium resources elsewhere in the world.

26614 (QER–1988) **[Quebec] Ministry of Energy and Resources annual report, 1987-1988.** Quebec Ministere de l'Energie et des Resources, Quebec, PQ (Canada). 1988. 100p. (In French). (MICROLOG–89-01851). Available from Ministere de l'Energie et des Ressources, Direction de la Recherche et du Developpement (Forets), 2700, rue Einstein, Sainte-Foy, PQ, Canada G1P 3W8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Quebec Ministry of Energy and Resources is responsible for ensuring the management and development of public lands and the forest, mineral, and energy resources of the province, taking into account the socioeconomic environment. In the energy sector, the Ministry favors the optimal development in Quebec of different energy forms and maximizing their economic impact for the benefit of industry. This report presents a review of the year's activities of the Ministry and its various sections. Financial statements are also included. 5 figs., 13 tabs.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 26442, 26472, 26494, 26659, 27341

26615 (ACERR–1987) **Alberta/Canada Energy Resources Research Fund annual review, 1986-1987.** Alberta/Canada Energy Resources Research Fund, Edmonton. 1987. 40p. (In English and French). (MICROLOG–88-05947). Available from Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta/Canada Energy Resources Research Fund was created in 1976 between the governments of Alberta and Canada to promote and support the development and efficient use of Alberta's existing and potential energy resources to meet the province's and Canada's medium- and long-term energy needs; and to encourage the development of scientific and technical expertise in energy research, development and demonstration in Alberta. The program includes the production, transportation, conservation and utilization

of both renewable and nonrenewable (fossil fuel) resources, generally excluding oil sands and heavy crude oil. This annual review highlights the research activities undertaken from April 1, 1986 to March 31, 1987. Program highlights are given, with short summaries of such successful projects as the development of a reliable thermographic detection system which could be mounted inside an aircraft and would pinpoint leaks in buried natural gas pipelines. The design and sale of a line of high-efficiency, non-condensing residential furnaces and two types of induced-draft unit heaters for use in commercial buildings. The use of pattern footwall anchoring as a means of reducing the amount of waste material to be removed from an open pit coal mine. The development of an independent test site where wind turbines can be shown to the public while their performance as water pumpers is monitored, recorded and analyzed. A method of sampling bacteria-containing water streams using a specially designed small diameter pipe called a Robbins Device, and the development of oil agglomeration process to reduce the mineral content of coal, while simultaneously recovering most of the coal fines. A financial statement is included.

26616 (A/ENR–7803) **Alberta/Canada Energy Resources Research Fund. Second annual report. April 1, 1977-Mar 31, 1978.** Keys, J.D.; Mellon, G.B. Alberta Energy and Natural Resources, Edmonton, AB (Canada). 1978. 12p. (CE–02545). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Alberta/Canada Energy Resource Research Fund was created in 1976 between the governments of Alberta and Canada, to promote and support the development and efficient use of Alberta's existing and potential energy resources to meet the province's and Canada's medium- and long-term energy needs; and to encourage the development of scientific and technical expertise in energy research, development and demonstration in Alberta. The program includes the production, transportation, conservation and utilization of both renewable and non-renewable (fossil fuel) resources, generally excluding oil sands and heavy crude oil. This first annual review summarizes the activities carried out from April 1, 1977 to March 31, 1978, including a description of each of the research programs or facilities approved and funded during the fiscal year; program objectives and guidelines; the terms of reference of the committee; and methods of review and approval of research projects. A financial statement is included. Projects include enhanced recovery of conventional crude oil, computer modelling technology, coal mining research, Alberta universities program, coal conversion research, energy conservation in sour gas processing, helium recovery from natural gas, sulphur/asphalt paving mix, solar and wind energy research, energy from waste wood, energy resources data system, insulation properties of flat roof membrances, efficiency of rotary piston engine and a district heating study (Edmonton).

26617 (DOE/ER/25054–1) **A broad research program on the sciences of complexity: Annual report.** Santa Fe Inst., NM (USA). 20 Dec 1988. 105p. DOE Contract FG05-88ER25054. Order Number DE89010483/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

1988 was the first full year of operation on the Santa Fe Institute, under multiyear grants from the Department of Energy and the National Science Foundation, with additional major grants from Citicorp, Russell Sage Foundation, and MacArthur Foundation. The research, educational, and publishing program of the Institute developed rapidly, especially in the last half of 1988. All of the seemingly disparate subjects in the program represent examples of complex systems with certain common properties that help define the content of an emerging general science of complexity. Major elements of progress in the SFI program were as follows: Economy; Theoretical Immunology; Global Security; Other Research; Summer School; Publishing Program; and Computer Support. This report describes proposed extensions of the 1988 programs into 1989 as well as proposed new workshops and research programs on complex adaptive systems; complexity, entropy, and the physics of information; 1989 complex systems summer school; evolution of human language; organization and evolution of prehistoric southwestern society; public policy studies; modeling human cognition and emotion; proteins, glasses, and spin glasses; theoretical ecology; and computational learning systems.

26618 (GAO/RCED–89-39) **Federal research assessment of small business innovation research programs.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Jan 1989. 191p. Available from OSTI - U.S. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877.

Since 1983, federal agencies with large research and development budgets have operated Small Business Innovation Research (SBIR) programs to strengthen the role of small innovative firms in federally supported research and development. SBIR awards to small business have totaled over $1.35 billion through fiscal year 1988. In reauthorizing SBIR programs in 1986, the Congress directed GAO to study their effectiveness in meeting SBIR goals, which are to (1) stimulate technological innovation, (2) use small businesses to meet federal research and development needs, (3) increase private sector commercialization of innovations from federal research and development, and (4) encourage participation by minority and disadvantaged firms in technological innovation. The Congress also directed GAO to compare the quality of SBIR research with more traditional agency research and to obtain the views of agency and department heads on how SBIR programs have affected other research activities at their agencies. To obtain information on how well SBIR programs are meeting their goals and on the quality of research, GAO sent questionnaires to firms with SBIR projects and to government project officers responsible for SBIR and other research.

26619 (HNEI–9010834) **Hawaii Natural Energy Institute: Annual report, 1987–1988.** Koehler, R.L. Hawaii Univ., Honolulu, HI (USA). Hawaii Natural Energy Inst. 1988. 65p. Available from OSTI - Hawaii Natural Energy Institute, University of Hawaii at Manoa, 2540 Dole Street, Holmes 246, Honolulu, HI 96822.

This annual report of the Hawaii Natural Energy Institute contains an overview of the Institute's current projects. These research programs include: biomass energy; geothermal energy; hydrogen energy; ocean energy; solar energy; wind energy; and renewable energy resources. (JF)

26620 (ORF/ES–8006) **A brief review of specialized research development and demonstration capabilities in energy programs.** Deshpande, A.S. Ontario Research Foundation, Mississauga (Canada). Energy Systems Centre. 1980. 36p. (CE–02472). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Ontario Research Foundation is a multidisciplinary non-profit organization established in 1928 to provide technical research and development support to industry and government. The Energy Group is an inter-disciplinary group representing all operating departments and formed to coordinate, promote and organize energy related technical activities. This document gives a description of the group's activities in solar energy, combustion, alternate fuels, energy conservation, building energy systems, and special studies such as the development of the Wetox wet oxidation process for the destruction of organic components of aqueous waste streams. Appendices present information on the Vortometric oil burner, a brief description of wet oxidation, and the CANWEL waste management concept.

2906 Nuclear Energy

Refer also to citation(s) 26397, 26600

2907 Transport and Storage

Refer also to citation(s) 26290, 26625

2908 Waste Heat Utilization

Refer also to citation(s) 26624, 26661, 26712

26621 (SAE–1944-1-1-1) **Edmonton district heating study. Financial feasibility.** Mears, D.D. Stanley Associates Engineering

Ltd., Edmonton, Alberta (Canada). 1980. 67p. (CE–02556). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study was undertaken to determine the technical and financial feasibility of developing a district heating system to serve the downtown area of Edmonton, using as the principal heat source low grade heat produced by the Rossdale Generating Station. The study focused on the economic and financial feasibility of the system, estimating the costs associated with district heating, forecasting the revenues of the system, and evaluating the system's financial feasibility under a number of economic and operating assumptions. The economic and environmental impacts of district heating were also considered, and recommendations were made concerning further development of the district heating system. The study considered two areas: the downtown core of the city, and an expanded area comprising all areas of downtown Edmonton including the provincial office buildings in the Government Centre area. Four system configurations were considered in the analysis of the capital costs. Financial feasibility was evaluated in relation to district heating service areas, heat production alternatives, natural gas price escalation rates, and reductions in the district heating tariffs, with alternative assumptions for each variable, making a total of 16 combinations. It was concluded that district heating would be both technically and financially feasible and that the city of Edmonton proceed with the development of such a system, to begin operation in the Fall of 1984. 12 figs., 4 tabs.

2910 Conservation

Refer also to citation(s) 26643, 26654, 26664, 26668, 26678, 26679, 26884

26622 (DOE/CE–0266) **Tenth annual report to Congress and the Secretary of Energy on the Nationwide Energy Extension Service Program.** National Energy Extension Service Advisory Board, Washington, DC (USA). Mar 1989. 17p. Order Number DE89011325/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Tenth Annual Report reviews the Energy Extension Service accomplishments over the past decade at the state and federal level and makes recommendations for the future. A brief description of the Energy Extension Service, including the Energy Extension Service funding history is also included.

26623 (QER/BEE–8710) **Evaluation of the energy consumption of the public sector in Quebec, 1984-1985.** Quebec Ministere de l'Energie et des Ressources, PQ (Canada). Bureau des Economies d'Energie. 1987. 35p. (In French). (MICROLOG–89-00843). Available from Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The energy consumption of the buildings of the public and parapublic sectors referred to in the Institutional Energy Program has amounted equal during the financial year 1984-85, to 35.7 millions GJ, which represents 2.9% of the total energy consumption of the province of Quebec and a decrease of 4.7% with respect to the energy consumption of the financial year 1983-84. The energy performance of the public and parapublic sectors in 1984-85 is 1.45 GJ/m^2, that is, an improvement of 4.6% with respect to the performance of 1983-84 which was 1.52 GJ/m^2. The repartition among the various forms of energy is given. The cost of this energy consumption in 1984-85 is $311.3 million, that is, an increase of 1.3% with respect to 1983-84 whereas the prices of energy increased by 5.4% for the province of Quebec and 2.8% for the commercial sector during the same period. The repartition among the various organizations and the various uses of energy is given. The investment to improve energy performance in 1984-85 would have amounted to $44.6 million. 19 tabs.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 26267, 26304, 26599, 27074, 27332

26624 (DOE/EIA–0035(89/01)) **Monthly energy review, January 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 25 Apr 1989. 143p. Order Number DE89010941/JAW. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Monthly Energy Review presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities. The Monthly Energy Review is intended to provide timely energy information to Members of Congress, to Federal and State agencies, and to the general public.

26625 (DOE/IE–0014) **Office of Energy Emergencies: Report for 1988.** USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC (USA). Office of the Deputy Assistant Secretary for Energy Emergencies. Dec 1988. 21p. Order Number DE89010072/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The Department of Energy has been anything but complacent about energy emergency preparedness. In fact, as a result of the Administration's emphasis on strategic oil stocks, international cooperation, and the interrelationship of national security and energy emergency preparedness, DOE has taken decisive steps to substantially strengthen and reorganize the Nation's ability to respond to energy emergencies and ensure an adequate supply of energy at reasonable cost. Powerful new management tools incorporated departmental capabilities and crisis management systems into a structurally integrated framework for supporting US preparedness. As a result of these tools, the Department has: developed procedures for and tested an Energy Emergency Management System to facilitate its ability to respond to foreign or domestic energy emergencies; established the Interagency Group on Energy Vulnerability to assess energy vulnerabilities, evaluate response options, and analyze the consequences of emergency scenarios; developed a cooperative energy vulnerability assessment program to work with the energy industries (electric, oil, gas, and coal) to study the domestic industry's facilities, security, and restoration capacity; and revitalized the National Defense Executive Reserves—industry executives who will augment DOE's energy crisis management during emergencies—by recruiting members, establishing new training programs, and arranging for them to participate in the Department's tests and exercises. 3 refs., 21 figs.

26626 (ESC-WR–89-08) **Two 'Low CO_2' energy scenarios for the Netherlands.** Kram, T.; Okken, P.A. Stichting Energieonderzoek Centrum Nederland, Petten (Netherlands). Energie Studie Centrum. Apr 1989. 22p. Available from Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Paper presented at IEA/OECD expert seminar on energy technologies for reducing emissions of greenhouse gases, Paris, France, 12-14 April 1989.

Scenario calculations are presented for the national energy system in the period 1980-2020. The scenarios reflect different world-wide socio-economic developments. A process-oriented dynamic national costs minimizing LP-model (IEA-MARKAL) was used. To identify cost-optimal CO_2-reduction strategies two scenarios were recalculated with a 50% reduction of CO_2-emissions in 2020. In both scenarios 50% CO_2-reduction is feasible at costs ranging from 36 to 42 Dfl/ton CO_2. A CO_2-constraint sharpens the contrast between both scenarios: the nuclear supply-oriented all-electric strategy in the 'Trend' scenario versus the demand-oriented gas strategy in the 'Green' scenario. Some options are chosen in both scenarios to reduce CO_2. It is recommended to direct R and D policy to these 'robust' options, which include energy conservation, materials recycling, renewable energy and high efficient gas conversion technologies. Accounting for indirect CO_2-emissions and non-CO_2 greenhouse gases from the energy system is not expected to change the optimal reduction strategies. 16 figs., 16 refs., 7 tabs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 26324, 26397, 26601, 26623, 26625, 26642

26627 (QME/REG–1988) **[Quebec] Electricity and Gas Board annual report, 1986-1987.** Quebec Ministere de l'Energie, Regie de l'Electricite et du Gaz, PQ (Canada). 1988. 23p. (In French). (MICROLOG–88-05548). Available from Regie de l'electricite et du gaz (Quebec), 2100 rue Drummond, Montreal, PQ, Canada H3G 1X1; $2.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report opens with an overview of the history of the electricity and Gas Board listing its upper management people. It lists the rulings of the Board as to natural gas supply, electricity sypply, vapor supply, and safety. For the year ending 31 March, 1987, the total receipts numbered at $2,635,329 and the total expenses, at $1,306,362. In appendices to the report are statistical data about sales of electricity, natural gas and vapor. 6 tabs.

26628 (QME/REG–1989) **[Quebec] Electricity and Gas Board annual report, 1987-1988.** Quebec Ministere de l'Energie, Regie de l'Electricite et du Gaz, PQ (Canada). 1988. 19p. (In French). (MICROLOG–89-01849). Available from Regie de l'electricite et du gaz (Quebec), 2100 rue Drummond, Montreal, PQ, Canada H3G 1X1; $2.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report opens with an overview of the history of the Electricity and Gas Board, listing its upper management people. Included are the rulings of the Board as to natural gas supply, electricity supply, vapor supply, and safety. For the year ending 31 March, 1987, the total receipts numbered at $2,635,329 and the total expenses, at $1,306,362. In appendices to the report are statistical data about sales of electricity, natural gas and vapor. 6 tabs.

2940 Fossil Fuels

Refer also to citation(s) 26265, 26280, 26281, 26286, 26475, 26614, 26624, 26627, 26628

26629 (DOE/EIA–M033) **Documentation for the State Energy Data System Diskettes.** USDOE Energy Information Administration, Washington, DC (USA). Aug 1988. 10p. Order Number DE89010704/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The State Energy Data System (SEDS) Diskettes contain data from the publication State Energy Data Report. The state data are grouped by Census Division with one division per diskette. In addition to the states in the Census Division, each diskette contains data for the United States. Each record is a maximum of 240 characters (bytes) in length and uniquely identified by state and a five-character key.

26630 (DOE/EIA–M035) **Documentation for the State Energy Price and Expenditure Data System diskettes.** USDOE Energy Information Administration, Washington, DC (USA). Dec 1988. 16p. Order Number DE89010705/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The State Energy Price and Expenditure Data System (SEPEDS) diskettes contain annual energy price and expenditure estimates for 1970–1986. The state data are grouped with one Census Region per diskette, except for Region 3 which is on two diskettes (Census Division 5 on one diskette and Census Divisions 6 and 7 on another). In addition to the states in the Region, each diskette contains data for the United States. Each record is a maximum of 240 characters (bytes) in length and uniquely identified by state and a five-character key.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 26261, 26423

26631 (NP–9764630) **On the significance of hydrogen for energy policies. An investigation through systems analysis.** Conrad, F. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse. May 1988. 31p. (In German). Order Number DE89764630/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

This investigation by the Nuclear Research Centre Karlsruhe (KfK) on the commercial production and application of hydrogen, frequently praised in euphoric terms in the media as the energy-carrier of the future, arrives at surprising and rather sobering results when looked at from an economically realistic point of view in the foreseeable future: As a directly useable secondary energy form, hydrogen will hardly be able to play a role within the time period considered likely before the possible exhaustion of crude oil reserves, but it will be able to do so as a chemical raw material for the production of synthetic fuels and chemical bases as a replacement for mineral oil products. The crucial disadvantage of hydrogen as energy is that it contains only one third as much energy as natural gas and can only be manufactured with a high energy consumption.

2960 Electric Power

Refer also to citation(s) 26286, 26627, 26628, 26629, 26630

26632 (DOE/EIA–0226(89/01)) **Electric power monthly, January 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 12 Apr 1989. 49p. Order Number DE89010588/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The Electric Power Monthly (EPM) focuses on the electric utility industry in the United States. Detailed plant level data are contained in the Electric Power Quarterly. More information can be obtained by writing or calling the National Energy Information Center, EI-231, Forrestal Building, Washington, DC 20585, (202) 586-8800. The data in this report are presented for a wide audience including Congress, federal and state agencies, the electric utility industry, and the general public. The Energy Information Administration (EIA) collected the information in this report to fulfill its data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. The 1988 values for net generation, consumption, and stocks in this issue are revised.

26633 (DOE/EIA–0292(87)) **An assessment of the quality of selected EIA data series: Electric power data.** USDOE Energy Information Administration, Washington, DC (USA). Office of Statistical Standards. 20 Apr 1989. 70p. Order Number DE89010969/JAW. Available from NTIS, PC A04 - GPO - OSTI.

The Energy Information Administration (EIA) collects and publishes data on all aspects of the electric power industry. Some of the data appear to represent very straightforward concepts: for example, sales of electricity to consumers and costs and quantities of fuel received at electric power plants. As with all survey data, however, anomalies have been observed in the published figures. These anomalies are not necessarily due to data errors, but could result from differences in the time period and concepts that the data represent. This report investigates these and other related issues to address the question of whether the published electric power data measure what they purport to measure. It is written for the user who wants to find out more about the data. 6 figs., 22 tabs.

26634 (DOE/SWP–8901) **Southwestern Power Administration 1988 annual report.** USDOE Southwestern Power Administration, Tulsa, OK (USA). 1988. 36p. Order Number DE89010833/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The theme is "fitness and efficiency." Covered in this annual report are: power sales, assets and investments, revenues and expenses, sources and uses of funds, financial statements, etc. (TC)

26635 (EPRI-CU–6089) **Bidding for electric resources: An industry review of competitive bid design and evaluation: Final report, May 1989.** Matousek, M.J. Electric Power Research Inst., Palo Alto, CA (USA); Strategic Decisions Group, Menlo Park, CA (USA). May 1989. 76p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Bidding has become an accepted method of securing both electric supply and demand-side management (DSM) resources in many parts of the country. Given the early stages of development of bidding systems, many critical questions remain regarding methods of designing requests for proposals (RFPs) and evaluation of bid proposals themselves. Through on-site interviews with those utilities currently involved with bidding, EPRI has identified some of the most pressing research issues. These include: reliability of non-utility capacity and DSM, the value of dispatchability, impact on

system operating costs impact on power quality, and long-term affect on utility profitability. The report discusses methods that utilities use to develop RFPs, evaluate price and non-price attributes of bids, and negotiate final contracts. It includes a survey which ranks the importance of 30 various evaluation criteria. Results of a workshop held with utility managers experienced in the bidding process are presented. Workshop participants discussed pros and cons of highly specific RFPs, the value of explicit evaluation criteria, the importance of ceiling prices, and the inclusion of DSM with supply side bidding. 8 figs., 5 tabs.

26636 (EPRI-CU-6300) **New dimensions in pricing electricity: Proceedings.** Electric Power Research Inst., Palo Alto, CA (USA). Apr 1989. 262p. (CONF-8809323--: Conference on new dimensions in pricing electricity, Syracuse, NY, US, September 28, 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The New Dimensions in Pricing Electricity Conference attracted 430 attendees from 43 states and 5 foreign countries. Experts representing the utility, regulatory, academic, and customer perspectives addressed issues which will shape electric pricing over the next decade. Session topics included: marginal costs: theoretical and practical issues, competitive forces driving pricing innovation, real-time pricing applications, hardware requirements for new pricing programs, regulatory and customer perspectives, and service differentiation through reliability, quality, and guarantees. Adapting the concepts presented at this conference to specific utility strategies provides the real challenge for future pricing. The answers lie in the ability to respond to change and form innovative solutions to the challenges of the electric power business.

26637 (ERCB-ST87-27) **Alberta electric energy, monthly statistics.** Energy Resources Conservation Board, Calgary, AB (Canada). 1987. vp. (CE-02543). Available from Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $20.00/YR CAN.

Statistical data are presented on electric power in Alberta, including power generation by utility, plant, and type of resource; fuel consumption of power plants; energy deliveries; energy used in hydro plants; hydro energy stored in reservoirs; power supply and disposition; net peak demand; and stack emissions from major thermal power plants. 10 tabs.

26638 (ESSA/T-320-U-564) **Emerging technologies impacting on electricity needs to the year 2020.** Greig, L.; Kelly, B.; Peters, R.; Brooks, D.; Torrie, R.; McInnis, B.; Robinson, J. Environmental and Social Systems Analysts Ltd., Toronto, ON (Canada). 1988. vp. (CE-02530). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

This project provides a view of the possible effects of technology change on the demand for electricity in Canada to 2020. The approach used is based on end-use analysis and simulation modeling of likely changes in the characteristics of 27 selected technologies in conjunction with scenarios of socio-economic development. Two scenarios were considered: a Throughput Society similar to the present economy; and an Information Society with a shift to a service sector based economy. Simulation results from 1981-2020 indicate the effects of changes in electrical technologies are potentially larger than those resulting from a shift in the structure of the economy. Simulation of technology change led to reduction in the growth of demand for electricity with either zero (Information Society) or negative (Throughput Society) growth in demand by 2020. A summary of discussions and recommendations from a workshop of managers from Canadian utilities that considered the project results and the need for utilities to actively respond to technology change is also included in the report. Appendices include more detailed information on electrical technology assessment by sector (residential, industrial, commercial), current trends in longterm forecasting techniques, and the market share of furnace equipment in new dwellings. 94 refs., 22 figs., 35 tabs.

26639 (HQ-1987) **Hydro-Quebec. annual report, 1987.** Hydro-Quebec, Montreal (Canada). 1987. 62p. (In French). (MICROLOG-88-05628). Available from Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual report for the Quebec electric utility presents an overview of the year's activities and its financial status, including export sales of electricity to New Brunswick, Ontario, New York State, and the New England states. Research programs and demonstration projects are described, as well as the utility's activities in Africa, Asia, and Latin America. Environmental and economic considerations for the province are presented. Financial data includes total sales, sales by sector, export sales, and rate changes. A financial statement is included. 12 tabs.

26640 (HQ-1988) **Hydro-Quebec annual report, 1987.** Hydro-Quebec, Montreal (Canada). 1988. 65p. (MICROLOG-89-01321). Available from Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

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26641 (HQ-8803) **[Hydro-Quebec] Proposed tariffs for 1988.** Hydro-Quebec, Montreal (Canada). 1988. 36p. (In French). (MICROLOG-89-01688). Available from Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Patrons of the Quebec market would prefer foreseeable prices which are advantageous with respect to the other energy sources and beneficial at the international level. The rates strategy in the coming years will also respect the following guiding principles: to maintain the territorial uniformity of the rates and to treat similarly clients with similar consumption characteristics; to translate, as far as possible and gradually, into the rates the cost associated with the delivery of the various products; to make easier the understanding and application of the rate tariff; to take into consideration the operating modes of patrons. After a brief description of the evolution of energy prices and of the financial situation of Hydro-Quebec, this statement presents the tariff proposition for 1988. It mentions next the tariff orientations which have been considered for the market of surplus electricity in Quebec. The effect of the proposed rate increase on each of the tariff categories is detailed. 1 fig., 11 tabs.

26642 (MEA-8703) **The Manitoba Energy Authority sixth annual report for the year ended March 31, 1988.** Manitoba Energy Authority, Winnipeg (Canada). 1988. 17p. (MICROLOG-89-01681). Available from Manitoba Energy Authority, 607-330 Graham Ave., Winnipeg, MB, Canada R3C 4A5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Manitoba Energy Authority is responsible for developing and implementing policies to ensure the long-term stability and availability of electrical energy supply to Manitobans. It is also responsible, through its Electrical Energy Marketing Committee, for negotiating export sales of electrical energy with other provincial utilities and with utililities in the USA. It is further responsible for promoting the establishment, development and operation of energy intensive industries within the province, and for coordinating all departmental and Manitoba Hydro activities related to industrial and employment benefits associated with the Limestone Generating Station Project. This report presents a summary of the Authority's activities for the year, including export agreements and negotiations and the associated sales figures. Financial statements of the Authority are also included. Some highlights included a power sale to Ontario Hydro

for 5.6 billion kWH to be supplied 1998-2003; and a seasonal diversity exchange agreement with the Northern States Power Company in the USA.

26643 (MRC–8708) **Electricity conservation supply curves for Ontario.** Brookes, D.; Torrie, R. Marbek Resource Consultants Ltd., Ottawa, ON (Canada). 1987. 79p. (MICROLOG–88-05564). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes the methods, data, assumptions, and calculations used to produce a set of preliminary electricity conservation supply curves for the residential, commercial, and industrial sectors, with one curve combining all sectors, in Ontario. General methodological issues and problems are discussed, as well as the specific methodology used, and future uses of the technique. Detailed calculations for each sector are included in the appendices. 24 refs., 6 figs.,

26644 (NBEPC–8806) **[New Brunswick Electric Power Commission] Fifteen year load forecast, 1988-2003.** New Brunswick Electric Power Commission, Fredericton (Canada). 1988. 49p. (MICROLOG–89-01685). Available from New Brunswick Electric Power Commission, 515 King St., Fredericton, NB, Canada E3B 4X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document presents a fifteen-year forecast of the electric requirements of the in-province customers of the New Brunswick Electric Power Commission. The load forecast is prepared each year based on a cause and effect analysis of past loads, combined with data gathered through customer surveys and an assessment of economic, demographic, technological and other factors which affect the utilization of electrical energy. In addition to the forecast requirements of each sales classification and total energy supply by month, this document includes a forecast of the monthly peak hour demand (the maximum amount of energy required in a one-hour period). The forecast results are used in overall short and long term planning, particularly the financial and facilities planning. The actual experience is likely to differ from the forecast and such differences are likely to be larger in the later years. Variations from the forecast can significantly affect the future financial and facilities requirements. Therfore this document includes a forecast range which provides a sensitivity of the forecast to various input parameters and their resulting impact on the final results. Total power demand is forecast to increase from 11,751 GWh to 17,598 GWh or 2.7%/y over the 15-year period; in the same period, the maximum peak demand is forecast to increase from 2336 MW to 3519 MW. These results differ from the 1987 fifteen-year forecast in that the overall energy forecast is 0.7% lower while the peak demand forecast is 3.6% higher. The changes are essentially due to revisions in the impact of electric space heating conversions. 12 figs., 18 tabs.

26645 (PB–89-156020/XAB) **Hierarchical knowledge-based system for model-based failure diagnosis in power plants.** Lautala, P.; Vaelisuo, M. Helsinki Univ. of Technology, Otaniemi (Finland). Control Engineering Lab. Dec 1988. 29p. (REPT–78). Available from NTIS, PC EE03/MF A01.

A hierarchical, modular real-time failure-diagnosis system for technical processes is presented. The symptom-detecting modules are written in algorithmic form and the methods used in our application are model based, but vibration analysis could also be used. The decision-making part is realized in a knowledge-based system module. First, the algorithms and the expert system are tested in a simulator. The experimental system is realized with microcomputers. The lower-level algorithmic modules run on a COMPAQ 386(R) microcomputer under GENESIS(TM), a process-control software. The decision-making part is done in OPS-83 language and run on a separate microcomputer. An application is made to failure diagnosis in a coal power plant, and some results are presented.

2980 Consumption and Utilization

Refer also to citation(s) 26265, 26632, 26633

26646 (DOE/EIA–0214(87)) **State energy data report: Consumption estimates, 1960–1987.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 20 Apr 1989. 472p. Order Number DE89010971/JAW. Available from NTIS, PC A20 - GPO - OSTI.

The State Energy Data Report presents estimates of annual energy consumption at the state and national levels by major economic sector and by principal energy type for 1960 through 1987. Included in the report are documentation describing how the estimates were made for each energy source, sources of all input data, and a summary of changes from the State Energy Data Report published in April 1988.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 26444

30 DIRECT ENERGY CONVERSION

26647 (PB–89-159214/XAB) **Abstract and discussion for the joint seminar on: recent advances in the electrochemistry of energy generation, storage, and conversion.** Faulkner, L.R.; Niki, K. East-West Center, Honolulu, HI (USA). Jan 1989. 253p. Available from NTIS, PC EE11/MF A01.

The volume contains the abstracts and transcripts of discussion for 34 presentations given in the Joint Seminar on Recent Advances in the Electrochemistry of Energy Generation, Storage, and Conversion, which was held in Honolulu in May, 1982. The initial pages provide the original program and the list of participants, then the abstracts and discussion transcripts follow in alphabetical order according to the surname of the participant responsible for them. The abstracts were submitted in advance of the meeting. The discussions were transcribed from tape recordings of the proceedings. It was not possible to secure transcripts of the discussions following all presentations, but transcripts are available for the great majority.

26648 (PB–89-902100/XAB) **Government research and development summaries: Chemical, Electrical, Mechanical, Nuclear, Te, Tl, Solar, and magnetohydrodynamic and systems. Monthly report.** CSR, Inc., Washington, DC (USA). Power Information Center. 1989. a Available from NTIS Subscription.

Supersedes PB–88-902100. Paper copy available on subscription, $550.00/year. U.S. sales only, excluding embassies. Additional subject categories available at a discount. Also available in single copies.

The Government Research and Development Summaries now available from NTIS are project Briefs prepared by the Interagency Advanced Power Group. They describe the status of all programs in the fields of advanced power research, development and engineering. Members of the Interagency Advanced Power Group (IAPG) are the U.S. Army, Navy, and Air Force, U.S. Department of Energy and the National Aeronautics and Space Administration (NASA). Their cooperative effort monitors government-funded research and development producing project briefs in the following categories. Chemical, Electrical, Mechanical, Nuclear, TE, Tl, Solar, and Magnetohydrodynamic and Systems. Each project brief contains: title; project description; contract number, period, probable completion date and funding; principle investigator name and telephone number; contractor name and address; directing agency and index terms.

3001 MHD Generators

26649 (DOE/PC/90281–1) **Integrated MHD Bottoming Cycle: First quarterly report, September 11–October 31, 1987.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Dec 1987. 27p. DOE Contract AC22-87PC90281. Order Number DE89010013/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Integrated MHD Bottoming Cycle project progress for September and October relates to Task 1–Modification of the Existing Coal Pulverizer and Dryer System, and Task 2–Design,

Fabrication, and Installation of an Automated Spent Seed/Ash Handling System. The project team was assembled and committed to the project. Team members attended a kickoff meeting at the Pittsburgh Energy Technology Center. The design approaches for the pulverizer modifications, the spent seed/ash handling system, and the air heater replacement for the existing vitiation heater were presented. Planning was initiated to distribute the authorized funding among the tasks. Work was started on the Management Plan, including the Work Plan, Milestone Schedule Plan, and Cost. This report covers task description and project status for the first two months of the project.

26650 (DOE/PC/90281–2) **Integrated MHD bottoming cycle: Second quarterly report, November 1, 1987–January 31, 1988.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Mar 1988. 31p. DOE Contract AC22-87PC90281. Order Number DE89010017/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Integrated MHD Bottoming Cycle project, progress for September and October relates to Task 1–Modification of the Existing Coal Pulverizer and Dryer System, and Task 2–Design, Fabrication, and Installation of an Automated Spent Seed/Ash Handling System. Drafts of the Preliminary Design Review packages for the Modification of the Existing Pulverizer and Dryer System and the Automated Spent Seed/Ash Handling System were submitted to DOE/PETC for review. B and W reviewed the system criteria for drying Montana Rosebud coal to 3% moisture. B and W concluded that the system suggested in the RFP would not achieve the required drying. B and W recommended that a pre-dryer be used in combination with drying in the pulverizer. B and W is proceeding to define the performance requirements and costs of a system using a pre-dryer. This report contains a project and task descriptions.

26651 (DOE/PC/90281–3) **Integrated MHD bottoming cycle: Third quarterly report, February 1–April 30, 1988.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. May 1988. 24p. DOE Contract AC22-87PC90281. Order Number DE89010016/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Integrated MHD Bottoming Cycle project progress for February through April relates to Task 1–Modification of the Existing Coal Pulverizer and Dryer System, and Task 2–Design, Fabrication, and Installation of an Automated Spent Seed/Ash Handling System. No activities were scheduled for Tasks 3 and 4 prior to or during this period. The Preliminary Design Review for the Automated Spent Seed/Ash Handling System were submitted to DOE/PETC for review. The design combination of rotary seal valves, screw feeders, weigh tanks and pneumatic transport was considered unacceptable. Modifications of equipment sizes and locations are required to accommodate additional hoppers to be added to the Superheater Test Module and maintain access to this equipment and existing equipment. B and W received estimates from three vendors for predrying equipment for the modification of the existing coal pulverizer and dryer system. This pre-dryer is necessary to permit drying Montana Rosebud coal to 3% moisture without excessive temperatures within the pulverizer.

26652 (DOE/PC/90281–4) **Integrated MHD bottoming cycle: Fourth quarterly report, May 1–July 31, 1988.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Aug 1988. 28p. DOE Contract AC22-87PC90281. Order Number DE89010015/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Integrated MHD Bottoming Cycle project progress for May through July relates to Task 1–Modification of the Existing Coal Pulverizer and Dryer System, and Task 2–Design, Fabrication, and Installation of an Automated Spent Seed/Ash Handling System and Task 4–Participation on the MHD Technology Transfer Integration and Review Committee. The Preliminary Design Report for the Automated Spent Seed/Ash Handling System was submitted to DOE/PETC for review. The design combination of rotary seal valves, screw feeders, weigh tanks and pneumatic transport was considered acceptable. Modifications of equipment sizes and locations are required to accommodate additional hoppers to be added to the Superheater Test Module and maintain access to this equipment and existing equipment. B and W located vendors who plan to submit quotations for dehumidification equipment needed to recycle inert gas with 3% oxygen to the pulverizer to complete the drying. 3 figs.

26653 (DOE/PC/90281–5) **Integrated MHD bottoming cycle: Fifth quarterly report, August 1–October 31, 1988.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Nov 1988. 30p. DOE Contract AC22-87PC90281. Order Number DE89010014/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Integrated MHD Bottoming Cycle project progress for August 1988 through October 1988 was in obtaining and reviewing vendor quotes for the coal dryer and modifying the system to eliminate the necessity of drying in the pulverizer. Vendor preliminary quotes for coal dryers were received. We received reports of drying tests conducted by the vendors. Test results were reviewed, and a decision to do all the drying in the dryer was reached. A final bid was received from one of the three vendors. We received several bids for the pneumatic conveyor portions of the Automated Ash/Seed Handling system. We received one bid and several no bids on the mechanical (screw) conveyor for the system. We have solicited two additional vendors. We plan to select the vendors for the Automated Ash/Seed Handling system in the next quarter, conduct the Critical Design Review and submit procurement approval packages for the equipment during the next quarter. 3 figs.

3003 Thermoelectric Generators

Refer also to citation(s) 26402

3004 Thermionic Converters

Refer also to citation(s) 26402

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 26425, 26426

3201 Buildings

Refer also to citation(s) 26462, 26689, 27094, 27128

26654 (AD-A–203143/3/XAB) **Evaluation of the effectiveness of ceiling fans for reducing heating requirements in Army facilities. Final report.** Augustine, L.J. Army Construction Engineering Research Lab., Champaign, IL (USA). Jan 1989. 23p. (CERL-TR-E–89/04). Available from NTIS, PC A03/MF A01.

Many claims have been made for ceiling fans as energy-saving devices. Fans destratify the air in a building; that is, they reduce the temperature differences between floor and ceiling. Depending on outside conditions, this can reduce heat loss. To quantify the effectiveness of fans during the heating season, USA-CERL, funded through a Facilities Engineering Applications Program (formerly FTAT) project, collected vertical thermal stratification measurements in Army buildings that had been equipped with ceiling fans. The buildings were located at Fort Carson, CO and Fort McClellan, AL. By analyzing how much the key building temperatures (ceiling, floor, and mean indoor) changed when ceiling fans were used, the USA-CERL engineers estimated the energy savings associated with fans. The results showed that, in general, the buildings with the greatest initial stratification showed the greatest savings. In addition, the degree of thermal stratification was determined to be a linear function of outside air temperature. However, more research is needed to determine the relationship between stratification and building characteristics. Thus, the degree of stratification in a building and possible factors affecting it should be evaluated carefully before installing ceiling fans.

26655 (AE/SESR–1-260) **The development of energy conservation demonstration buildings in Alberta.** Alberta Energy, Edmonton (Canada). Scientific and Engineering Services and Research Div. 1988. 12p. (MICROLOG–89-00883). Available from Alberta Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy,

Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

During the early 1980s, the Alberta/Canada Energy Resources Research Fund provided financial support for several demonstration projects related with concerning energy in buildings or commercial establishments. Two involved buildings open to the public to acquaint people with energy conservation concepts and technologies; these projects are described in this booklet. The Edmonton Energy Conservation Centre is a 2 story dwelling with a full basement and 205 m^2 of floor space. The retrofit work on the main floor, upper floor, basement, exterior, windows, attic, heating and ventilation systems is described. Visitors to this centre can learn from displays, video presentations and printed materials. The Energy Efficicent Community Centre of Anzac, Alberta, is in developmental stage. The total envisaged space is 370 m^2 and the building cost is estimated between $250,000 and $500,000. The cost of the solar gain in the greenhose and other activity areas is intended to be absorbed initially by a concrete slab floor.. The heat circulation and thermal insulation of the building are described. 11 refs., 6 figs.,

26656 (AE/SESR–1988) **Some energy-conserving concepts for residential buildings.** Alberta Energy, Edmonton (Canada). Scientific and Engineering Services and Research Div. 1988. 16p. (MICROLOG–89-00636). Available from Alberta. Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Approximately 16% of all the energy consumed in Canada is used to heat residential buildings. Beginning in 1979, several research and demonstration projects related to energy conservation in residential buildings were initiated and funded by the Alberta/Canada Energy Resources Research Fund. Three are described here. The first is the energy-efficient housing display program in 1980/81. Ten demonstration homes were built; the energy savings were found less than expected or even nill. The designs of these homes were compared and correlated with the heating costs for real or "ideal" houses. The second project deals with heat recovery using heat pipe technology. In recent years, heat pipe technology developed for the American space program has proven to be a reliable and simple means of transferring heat over short distances. An air-to-air heat exchanger was thus designed and field-tested. The third project deals with an energy-efficient masonry fireplace. Design, performance testing and retrofitting are discussed. 9 figs.

26657 (CONF-890584–1) **Comparison of the dynamic thermal performance of insulated roof systems.** Courville, G.E.; Shipp, P.H.; Petrie, T.W.; Childs, P.W. Oak Ridge National Lab., TN (USA). 1989. 24p. DOE Contract AC05-84OR21400. From 9. conference on roofing technology; Gaithersburg, MD, US; May 4, 1989. Order Number DE89006628/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Large Scale Climate Simulator at the DOE-sponsored Roof Research Center has been used to provide data for a comparison of the thermal resistance of three common roof insulations over an extended range of temperatures using two different techniques; one steady state and the other transient. The insulations are fiberglass, expanded polystyrene (EPS), and phenolic foam board. R-values are determined for temperatures ranging from 10°F to 130°F. Results from the two techniques are in agreement with one another and both are within 5 percent of reference values for the insulations. The testing illustrates the flexibility of the Large Scale Climate Simulator. 8 refs., 11 figs., 1 tab.

26658 (DOE/CE/15331–T1) **Final report on statement of work objectives.** Enerzone Systems Corp., Dallas, TX (USA). 10 Mar 1989. 3p. DOE Contract FG01-87CE15331. Order Number DE89010490/JAW. Available from NTIS, PC A02 - OSTI.

VENTILATION SYSTEMS/damping; PROGRESS REPORT; VENTILATION; AIR CONDITIONING; HEATING SYSTEMS; COOLING SYSTEMS; RETROFITTING; NOISE; DUCTS; DAMPING; VENTILATION BARRIERS

26659 (DOE/CE/63525–T1) **Seniors Weatherization and Training (SWAT): Partnerships in Low Income Residential Retrofit: Model implementation program: Final report.** Kentucky Energy Cabinet, Lexington, KY (USA). Jan 1989. 250p. DOE Contract FG01-86CE63525. Order Number DE89010829/JAW. Available from NTIS, PC A11 - OSTI.

The objective of US DOE's program, entitled Partnerships In Low Income Residential Retrofit (PILIRR), is to demonstrate that sufficient interest and resources exist at the state and local levels to leverage public resources devoted to weatherization. Furthermore, it was US DOE's objective that each state develop a workable model that could be readily transferable to the other states of the nation for their possible use and adoption. This report describes the Kentucky model for leveraging public resources devoted to weatherization of dwellings occupied by older adult Kentuckians.

26660 (DOE/SF/15927–T1) **Optics and materials research for controlled radiant energy transfer in buildings: Sixth annual report of research, 1 January 1988–28 February 1989.** Goldner, R.B.; Haas, T.E. Tufts Univ., Medford, MA (USA). 1989. 14p. DOE Contract FG03-85SF15927. Order Number DE89009099/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There is currently world-wide interest in developing practical electrochromic smart windows. This is because the use of such windows could have significant impact on making buildings more energy efficient, and therefore could significantly influence the world's economy and international policies. This is especially important since more than 1/3 of the energy consumed in the US is used to control the climate of buildings. The Tufts research program has focused on theoretically and experimentally: identifying, designing, depositing, and evaluating thin film materials as individual layers and in multilayer window device structures. The current window device design is based on electrically varying the reflectivity of a EC (electrochromic) layer in a 5-layer structure: [TC(=ITO)|EC (=C-WO_3)|IC (= a – LNO)| CE (=In_2O_3)|TC (=ITO)]; where TC = transparent conducting layer, ITO = tin-doped indium oxide, c – WO_3 = (poly)crystalline tungsten trioxide, IC = ion conducting layer, a – LNO = amorphous lithium niobate, and CE = counterelectrode layer. 4 refs.

26661 (EPRI-EM–4694) **Heat pumps in complex heat and power systems: Final report.** Hindmarsh, E.; Ranade, S.M. Electric Power Research Inst., Palo Alto, CA (USA); TENSA Services, Houston, TX (USA). Apr 1989. 355p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report documents the results of an investigation into the placement of heat pumps in complex heat and power systems. The primary goal of this project was the development of a systematic procedure for determining the appropriate integration of heat pumps in industrial sites. Pinch technology, heat pump theory and site utility system theory form the foundation of this work. In this report, a novel procedure for identifying the optimal placement and sizing of heat pumps for industrial process applications is presented. The procedure, which is capable of being automated, incorporates both thermodynamic and economic evaluations to assess the incentives for heat pumping in candidate processes. Equations for evaluating true values of plant utilities are presented, and generic opportunities for the appropriate integration of heat pumps in total sites are delineated. The issue of heat integration versus heat pumping has also been addressed. 44 refs., 89 figs., 43 tabs.

26662 (IKE–7-11) **Saving energy and reducing the emission of air pollutants by renewal of oil- and gasfired boilers in 51 residential buildings. Final report.** Bach, H.; Diemer, R. Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). May 1988. 195p. (In German). Order Number DE89764517/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

The yearly energy consumption and emission of the air pollutants SO_2, NO_x, CO and C_nH_m of 51 residential buildings, basically single-family dwellings, are determined in field before and after renewal of the central oil- or gasfired boilers under uniform boundary conditions, especially constant occupancy behaviour. In almost each building energy saving rates are obtained by this retrofit but with different magnitude. The emission of the air pollutants reduces in some of the investigated buildings, in others increases despite energy savings within a wide range. The saving rates obtained depend on the properties of the structure, the heating network, the old

as well as the new boiler and moreover on the occupancy behaviour. Therefore they only refer to the special building and cannot be simply transferred to other arbitrary residential buildings.

26663 (IPB-GB–11/85) **Experimental studies of the influencing parameters of sound absorber constructions. Final report. Pt. 1.** Fischer-Scheyhing, S.; Ackermann, U. Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.). 18 Mar 1986. 79p. (In German). Available from Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.).

The report reports on sound-absorbing constructions sealing secondary sound transmission pathways, e.g. cavities above false ceilings or explosion safety openings. Commonly, these constructions are made up of mineral fiber boards. The project intended to investigate the different influencing parameters and compare them with calculated values. The parameters investigated were: Thickness of the insulating layer, specific gravity, absorption material, length-dependent flow resistance, and plate orientation. The sound absorption efficiency R_e was determined in dB using the substitution principle in accordance with the draft standard DIN 45 646 (Measurements of sound absorbers in ducts) on a sound absorber test bench. Five different mineral fiber materials were investigated.

26664 (MRC–8705) **Appliance efficiency information base.** Marbek Resource Consultants Ltd., Ottawa, ON (Canada). 1987. 252p. (MICROLOG–88-05671). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This is the final report of a project to assess new United States appliance legislation for its expected impact on appliance efficiency levels in U.S. markets and the likely timing of its introduction. Its objectives are to provide a comparative assessment of existing and potential energy performance improvement for Canadian manufactured appliances relative to products manufactured in the U.S. and by selected offshore manufacturers; to consolidate information and data on the Ontario/Canadian appliance manufacturing industry and markets that will assist in identifying energy and industry impacts of appliance efficiency programs; to assess the potential impact of the introduction of U.S. appliance standards on the Ontario/Canadian manufacturers; and to provide a workshop for discussion with key U.S. figures involved in the design and development of U.S. appliance standards research and legislation. Products covered include such kitchen/laundry appliances as refrigerators, freezers, ranges, dishwashers, and clothes washers and dryers, and such heating/cooling equipment as furnaces, air conditioners, heat pumps, domestic water heaters, pool heaters, and room heaters. Most of the data refers to kitchen/laundry appliances. Activity in the 1986 Canadian appliance market provides data on the number of units produced in Canada, the Canadian sales (domestic, imported, and total), and the exports from Canada for each of the 6 major kitchen and laundry appliances plus microwave ovens. Two forecasts of appliance sales are presented. Also included are company profiles, and the United States National Appliance Energy Conservation Act of 1987. 52 refs., 19 figs., 42 tabs.

26665 (NEI-DK–138) **Thermatically sealed double window panes with distended plastic film between them.** Lund Nielsen, B. Jysk Teknologisk, Aarhus (Denmark). Byggeteknik. May 1988. 48p. (In Danish). Order Number DE88757301/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

EFP-84.

On the basis of a literary study this report examines improved methods of calculating the U-value and the solar factor for double glazings with plastic films suspended vertically in the air gap. The methods take into account that plastic film is capable of transmitting infrared radiation. Annex 1 includes copies of computer programs developed during the project. The programs calculate the U-value and the solar factor of glazings according to the above improved methods. The report further includes sections about the coating of glass and plastics and of the aging of plastic film. (author) 13 refs.

26666 (OAF–88-035) **Water source heat pumps.** Spieser, H. Ontario Ministry of Agriculture and Food, Toronto, ON (Canada). 1988. 2p. (MICROLOG–89-01127). Available from Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The geothermal energy storage capacity of soil or groundwater can be used by water source heat pumps to heat and cool your home or barn and supply hot water. The booklet describes heat pump operation, defines the coefficient of performance of the system, lists the types of heat extraction systems (open and closed loop systems), and concludes that water source heat pumps at present are more costly than conventional forced air furnaces, but that, when air-conditioning is required and detailed payback calculations are done, water source heat pumps often have a cost recovery period of under 5 years. 2 refs., 2 figs.

26667 (OAF/AE–774-42) **Performance of a ground loop buried one metre deep.** Spieser, H. Ontario Ministry of Agriculture and Food, Toronto (Canada). Agricultural Energy Centre. 1986. 10p. (MICROLOG–89-01131; CE–02573). Available from Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Monitoring was carried out on a heat pump system which was coupled to a ground loop buried one metre below the soil surface. Loop entering temperatures remained within 3 to 5°C of undisturbed soil temperature at the same 1 m depth. This grand loop performs well as the heat source/heat sink for this home heating system. The fact that nearly half the loop is buried in saturated soil aids this loop in remaining above freezing through the winter months. The cost of its operation is calculated. 1 ref., 1 fig., 2 tabs.

26668 (PB–89-145742/XAB) **Building Physics research and development 1984-88.** Statens Provningsanstalt, Boraes (Sweden). 1988. 187p. (SP-RAPP–1988:51). Available from NTIS, PC EE07/MF A01.

This report presents activities on research and development in the field of Building Physics. The activities include thermal insulation, airtightness, moisture, radon, and indoor environment. The report consists of external publications via articles and contributions to symposia, etc. Furthermore, many reports have been published both within and outside the Swedish Building Institute. Most of them are in Swedish but some are written in English.

26669 (PB–89-151476/XAB) **Radon reduction and radon-resistant construction demonstrations in New York. Final report, September 1986-June 1988.** Nitschke, I. Fleming (W.S.) and Associates, Inc., Syracuse, NY (USA). Jan 1989. 299p. Available from NTIS, PC A13/MF A01.

The report covers three tasks related to indoor radon: (1) the demonstration of radon reduction techniques in 8 houses in each of two uniquely different radon prone areas of the State of New York; (2) the evaluation and repair of 14 radon mitigation systems in houses mitigated 4 years earlier; and (3) the development and application of radon resistant new construction designs in 15 different houses. In applying radon reduction techniques in existing houses, techniques which were applicable in extremely porous soil were not as easily applied to houses built on granite ledge; combinations of techniques may be required in many difficult houses before an acceptable radon level can be achieved. During the study, basement pressurization was applied as a radon reduction technique for the first time. The radon resistant new construction designs should demonstrate effective methods of sealing out radon during construction; however, quality control problems prevalent in the construction industry may require additional laboratory tests for verification.

26670 (PNL–6839) **Users guide for ENVSTD program Version 2.0 and LTGSTD program Version 2.0.** Crawley, D.B.; Riesen, P.K.; Briggs, R.S. Pacific Northwest Lab., Richland, WA (USA). Feb 1989. 76p. DOE Contract AC06-76RL01830. Available from Battelle Memorial Institute, Pacific Northwest Laboratory,Richland, WA 99352.

On January 30, 1989, the US Department of Energy (DOE) promulgated 10 CFR Part 435, Subpart A, an Interim Rule entitled "Energy Conservation Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings;

Mandatory for New Federal Buildings." As a consequence, federal agencies must design all future federal commercial and multifamily high rise residential buildings in accordance with the Standards, or show that their current standards already meet or exceed the energy-efficiency requirements of the Standards. Although these newly enacted Standards do not regulate the design of nonfederal buildings, DOE recommends that all design professionals use the Standards as guidelines for designing energy-conserving buildings. To encourage private sector use, the Standards were presented in the January 30, 1989, Federal Register in the format typical of commercial standards rather than a federal regulation. As a further help, DOE supported the development of various microcomputer programs to ease the use of the Standards. Two of these programs—ENVSTD (Version 2.0) and LTGSTD (Version 2.0)—are detailed in this users guide and provided on the accompanying diskette. This package, developed by Pacific Northwest Laboratory (PNL), is intended to facilitate the designer's use of the Standards dealing specifically with a building's envelope and lighting system designs. Using these programs will greatly simplify the designer's task of performing the sometimes complex calculations needed to determine a design's compliance with the Standards. 3 refs., 6 figs.

26671 (SAND–88-2580C) **The development of a vapor compression refrigeration system for a network of nine temperature test chambers.** Baca, R. Sandia National Labs., Albuquerque, NM (USA). 1988. 21p. DOE Contract AC04-76DP00789. (CONF-890592–1: 35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment, Anaheim, CA, US, May 1, 1989). Order Number DE89007084/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The thermal response of a component or system can be determined by exposure to a temperature environment simulated in a temperature chamber. The variation in both the size of the item under test and the desired temperature environment necessitates the need for test chambers with a range of capabilities. Most temperature chambers are equipped with a two-stage vapor compression refrigeration system and a heating system capable of simulating any temperature environment in the range of -65°C to 177°C. The refrigeration required to maintain a desired temperature level is a small fraction of the refrigeration required to lower the temperature in the chamber. Since most of the test time is spent maintaining a temperature level in the chamber, the refrigeration system is inherently inefficient and costly to operate. In order to increase the refrigeration system efficiency, a two-stage vapor compression refrigeration system has been developed to support nine temperature test chambers simultaneously. By networking chambers to a centralized refrigeration system, a larger percentage of the available refrigeration capacity is utilized. Moreover, each chamber can simulate a temperature environment which is independent of the other simulated temperature environments in the network. 2 refs., 10 figs., 2 tabs.

26672 (SBI-R–194) **Testing methods for insulation material used as underlay for roofing felt.** Nicolajsen, A. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1988. 50p. (In Danish, English). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

In cooperation with a number of Danish manufacturers of insulation materials and roofing felts the Danish Building Research Institute (SBI) has carried out an investigation of test methods for testing the performance of insulation materials used as underlay for roofing felt. The methods investigated were the ones worked out by the UEAtc. The purpose of the investigation has been to study if the methods were directly applicable for Danish conditions or if they were too much influenced by thermal insulation traditions in the central part of Europe. This question is of very much importance considering the harmonization efforts within the EC in order to achieve a market without trade obstacles for all building products as from end 1992. The investigation showed that in a number of cases the testing methods were not well suited for Danish conditions. Consequently a number of modifications of the methods have been proposed in the report, and in some cases quite different testing methods have been used. In cases where new methods have been used it should be noted that such methods have been in use in Denmark for a number of years, so that quite a good experience exists regarding the suitability of these methods. In the report the UEAtc methods are briefly presented and the reason for changes in the methods or choosing other methods is given. Where other methods are used these originate from TOR and the contents of the methods is shortly described. It is planned that the methods will be published later in a special publication issued by TOR.

26673 (SBI-R–196) **Fresh air valves. Position and function in mechanically ventilated multi-storey buildings.** Bergsoee, N.C. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1989. 46p. (In Danish). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

The background for the project described in this report is the stipulations of the Danish Building Regulations, Chapter 11.2.2 regarding the mounting of air inlets in windows or outer walls in dwellings. The objective of this project is to furnish manufacturers and technicians with an improved basis for appropriate designing and positioning of air inlets. Introductory the report describes, based on general functional requirements and fundamental air inlets, a number of inlets with distinctive features. A.o. the following types of air inlets are described: inlets designed for mounting in connection with radiators, inlets that supplies outdoor air with a high impulse, moisture-controlled inlets and inlets holding sound insulating materials. Subsequently, the report summarizes the experience and main results obtained from selected, previous studies. (SM).

26674 (SBI-R–198) **Humidity conditions in renovated high-rise buildings with three ventilation solutions.** Nielsen, O. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1989. 31p. (In Danish). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

In connection with the renovation of two high-rise apartment buildings using different methods of ventilation The Danish Building Research Institute examined humidity conditions before and after renovation took place. Air velocities in the living area of one of the buildings were also examined. The methods of ventilation were those which occurs naturally through leaks and open windows only - with mechanical injection in living area and mechanical exhaust from kitchen and bathroom in addition to 20 cm2 outdoor air valve in living area facade and, thirdly, with sealed facades, windows and doors and a 30 cm2 valve in the facade of each room. Air velocity conditions were measured in three flats where mechanical injection and exhaust were established and where part of the indoor air was taken in unheated through valves in the facade. Significant variations were found in relation to the three ventilation methods. Significant variations in humidity conditions were found in relation to the three ventilation solutions. In the building with mechanical injection and exhaust the air humidity conditions were measured as satisfactory. Only in a few flats did the air humidity exceed the limit which might cause condensed moisture on normal double-glazed windows and above the value of about 45 per cent RF at 21 deg. C, often recommended as the upper limit in the coldest season to combat house dust mites. In the building with the original ventilation, with re-sealed facade and installation of a 30 cm2 valve in the facade of each room too high air humidities were measured in many of the flats. The mechanically injected air flow, and the air entering through the outdoor valves did not in general create too high air velocities in the living areas. (AB).

26675 (SBI-R–202) **Air quality in newly built schools without mechanical ventilation.** Valbjoern, O.; Aggerholm, S. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1989. 36p. (In Danish). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

EFP-84.

The investigation has included measurements of carbon dioxide concentration in five schools without mechanical ventilation and one school with a mechanical exhaust ventilation system. Carbon dioxide concentration, air temperature and humidity were measured. Carbon dioxide concentration average 0.20 per cent in the schools without mechanical ventilation (0.13 per cent in the school with the lowest concentration) and 0.08 per cent in the school with the mechanical system. In the schools without mechanical ventilation the total ventilation air rate averaged 33 litre per second for one classroom which corresponds to 2 litre per second per pupil. But there were large variations among rooms. In the school with mechanical

exhaust system the ventilation air rate was about 115 liters per second per class room or about 8 liters per second per pupil. Heat consumption (except boiler losses) was between 84 to 117 kWh/m2 per year, and the electricity consumption between 35 to 51 kWh/m2 per year. Energy consumption in the school with a mechanical exhaust system did not differ essentially from the others. Calculations show that the expected additional consumption by introducing mechanical ventilation with heat recovery and a fresh air rate corresponding to the school with mechanical exhaust system would increase both heat and electricity consumption by approx. 5 per cent. This figure is less than the mutual difference between the schools without mechanical ventilation. Mechanical ventilation should be installed in order to keep the carbon dioxide concentration below 0,10 per cent. Carbon dioxide concentration could be reduced considerably if a consistent airing during the class hours and breaks was carried out. (AB) 13 refs.

3202 Transportation

26676 (DE–8208) **Evaluation of potential improvements in automobile fuel consumption at low temperatures. Phase 2. Vol. 2, appendices. Final report.** Davis Engineering Ltd., Ottawa, Ontario (Canada). 1982. 119p. (CE–02446). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A test program was conducted to evaluate specific engine modifications for fuel consumption, exhaust emissions, and driveability at low ambient temperatures. This document presents descriptions of the procedures for: vehicle driveability evaluation; vehicle tuneup; calibration of road load power control and dynamometer; determining dynamometer frictional power losses; plotting torque/speed and hp/speed curves; and laboratory testing. A correction factor is given for propane fuel consumption. Dynamometer horsepower calculations are presented for different test temperatures. Also included are data on Transport Canada driving cycles, test quality control, calibration of automatic idle speed maintenance for one of the test vehicles, and a program listing of the fuel consumption and exhaust emissions calculation. 13 figs., 8 tabs.

26677 (EGG-MS–8425) **NDE of the space shuttle orbiter thermal protection system: Phase 2 final report.** Tow, D.M.; Barna, B.A.; Rodriguez, J.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1989. 54p. DOE Contract AC07-76ID01570. Order Number DE89010975/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Research continued on the development of a nondestructive evaluation technique for inspecting bonds on the space shuttle orbiter thermal protection system tiles. The approach taken uses a noncontacting laser sensor to measure the vibrational response of bonded tiles to acoustical excitation. Laboratory work concentrated on investigating the dynamic response of "acreage" tiles, i.e., tiles covering the underside of the orbiter, all approximately square. A number of promising unbond signatures have been identified in the time and frequency domain response. Field tests were conducted to study environmental effects on the techniques being developed. The ambient motion of the orbiter was found to be larger than expected, necessitating modifications to current techniques. 2 refs., 21 figs., 1 tab.

26678 (PB–89-149744/XAB) **Bus/rail interface design guideline manual.** Southern California Rapid Transit District, Los Angeles, CA (USA). Oct 1988. 36p. Available from NTIS, PC A03/MF A01.

The document provides a guide for the design and placement of bus-related facilities and amenities when integrated with rail operation. It presents criteria for station location and delineates functions to be provided for bus/rail interface stations. Rationale for revising existing bus routes to serve rail stations is also presented and types of amenities to be furnished along with rationale that justify provision are discussed. Design criteria that indicate minimum specifications for acceptable operations are included.

26679 (PB–89-161715/XAB) **Evaluation of employer-distributed transit pass programs in Texas. Technical report (Final).** Bullard, D.L. Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst. Feb 1988. 163p. (TTI–2-10-87-1084-1F). Available from NTIS, PC A08/MF A01.

This report reflects the view that the concept of selling and distributing transit passes through employers is an idea whose time has come. The transit agencies studied perceive these programs to be worthwhile investments for encouraging transit acceptance and use while lowering employee commuting costs and reducing the need for activity center parking. The study was undertaken to evaluate the types of employer-distributed transit pass programs currently in operation in major Texas cities and selected cities outside Texas. The information presented in the report will assist transit agencies and employers in implementing new or improving existing employer distributed transit-pass programs. The basic intent of the investigation was to: identify the types of programs in operation; determine the impacts of programs on transit agencies, employers, and employees; and document the findings in order to assist transit agencies and employers in implementing employer-distributed transit pass programs.

26680 (SAND–88-0626) **Survey of states for existence of large-truck accident rates and computerized databases that could be analyzed to obtain large-truck accident rates.** Wolff, T.A. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 36p. DOE Contract AC04-76DP00789. Order Number DE89008950/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report reviews truck-accident rate data for purposes of understanding existing highway accident information systems and evaluating existing data to obtain large-truck accident rate information for input to risk-assessment models. Several state highway accident information systems are reviewed, and large-truck accident rates are compiled and discussed. 62 refs., 5 tabs.

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Refer also to citation(s) 26434, 26434, 26462, 26661, 26661, 26809

26681 (ACERR–U17) **Production of hydrogen and sulphur from hydrogen sulphide. Six-month report covering the period October 1, 1979 - March 31, 1980.** Chivers, T.; Lau, C. Alberta/Canada Energy Resources Research Fund, Edmonton. 1980. 37p. (CE–02561). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the details of the following studies: measurements of H_2 yields versus time as a function of temperature for different sulphides in a closed circulating system; attempts to optimize H_2 yields through further investigations of mixed catalysts and the use of solid supports; the effects of carbon powders and their mixtures with metal sulphides on the decomposition of hydrogen sulphide; survey and evaluation of various processes for the separation of H_2 from H_2-H_2S mixtures; the application of thermal diffusion columns in the thermal decomposition of H_2S and the separation of H_2 from H_2-H_2S mixtures; and a preliminary cost analysis comparing the Claus process with the thermal decomposition process. 19 figs., 3 tabs.

26682 (AC/R–88-5500) **Reduction of fuel use in grain drying.** Otten, L.; Levesque, M. Agriculture Canada, Ottawa, Ontario. Research Branch; Wellington Applied Sciences, Guelph, ON (Canada). 1988. 294p. (MICROLOG–89-01140). Available from Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The main reason for the review of the grain drying research was the development of a list of research priorities based in part on a cost/benefit analysis. A secondary objective was the presentation of useful information. Very little, however, was found to address the primary objective. The technology assessment covers the following subjects: current drying systems (low-temperature drying, high temperature drying); novel drying systems (microwave drying, desiccant drying, solid-solid contact drying, fluidized and spouted bed drying, use of preservatives in low-temperature drying), heat recovery systems (recycling of cooling air and exhaust, heat exchangers, heat

pump drying), alternate energy sources (solar energy, biomass), grain characteristics and research priorities. 506 refs., 2 figs., 11 tabs.

26683 (AD-A–203899/0/XAB) **Power-efficient hydraulic systems. Volume 1. Study phase. Final report, October 1985-July 1988.** Hupp, R.V.; Haning, R.K. Rockwell International Corp., Columbus, OH (USA). North American Aircraft Operations. Jul 1988. 239p. (NA–88-0001-VOL-1). Available from NTIS, PC A11/MF A01.

See also Volume 2, AD-A203 900.

Energy-saving concepts for aircraft hydraulic systems were studied in a two-phase program. Task I was an investigation of methods and techniques to reduce overall hydraulic-system power requirements by lowering system demands and increasing component efficiencies. Task II involved hardware demonstration test on selected concepts. Task I: Study Phase. A baseline hydraulic system for an advanced aircraft design was established. Twenty energy-saving techniques were studied as candidates for application to the baseline vehicle. A global systems-analysis approach was employed. The candidates were compared on the basis of total fuel consumption and six qualitative factors. Nine of the most-promising techniques were applied to a Target System . The target system had a 28% reduction in energy consumption and an 868 lb weight reduction over the baseline aircraft.

26684 (AD-A–203900/6/XAB) **Power-efficient hydraulic systems. Volume 2. Hardware demonstration phase. Final report, October 1985-July 1988.** Hupp, R.V.; Haning, R.K. Rockwell International Corp., Columbus, OH (USA). North American Aircraft Operations. Jul 1988. 204p. (NA–88-0001-VOL-2). Available from NTIS, PC A10/MF A01.

See also Volume 1, AD-A203 899.

Energy-saving concepts for aircraft hydraulic systems were studied in a two-phase program. Task I was an investigation of methods and techniques to reduce overall hydraulic-system power requirements by lowering system demands and increasing component efficiencies. Task II involved hardware demonstration tests on selected concepts. Task I: Study phase. A baseline hydraulic system for an advanced aircraft design was established. Twenty energy-saving techniques were studied as candidates for application to the baseline vehicle. A global systems analysis approach was employed. The candidates were compared on the basis of total fuel consumption and six qualitative factors. Task II: Hardware demonstration phase. Two techniques demonstrated for energy savings were control valves with overlap and dual pressure-level systems. Tests were conducted on control valves, a servo actuator, dual pressure pumps, and a lightweight hydraulic system simulator. Valves with 0.002-in. overlap reduced system energy consumption 18% compared to using valves with zero lap. Operation at 4000 psi reduced system energy consumption 53% compared to operation at 8000 psi. Pressure-level switching was accomplished with excellent results.

26685 (AE/SESR–1988) **Methods for the recovery and reuse of waste heat in some commercial operations.** Alberta Energy, Edmonton (Canada). Scientific and Engineering Services and Research Div. 1988. 11p. (MICROLOG–88-05701). Available from Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This reports on three demonstration projects funded by the Alberta/Canada Energy Resources Research Fund to recover and reuse waste heat in a meat packing plant, a dairy operation, and a commercial laundry. A short description of each project, flow diagrams, and results obtained are provided. The systems were monitored and natural gas and water consumption was measured before and after installation of heat recovery equipment. Savings in all three projects were significant, with an increased bonus for the meat packing plant of reducing down-times due to electrical power outages from 45 minutes to 10 minutes or less, thereby resulting in increased savings. 5 figs.

26686 (CIPEC–88091888) **Canadian industry program for energy conservation.** Canadian Industry Program for Energy Conservation, Ottawa, Ontario. 1988. 84p. (MICROLOG–89-00436; CE–02069). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C.

This report outlines the activities of a Canadian program, sponsored by government and administered by industry, for promoting and monitoring energy efficiency throughout Canadian industry. Program objectives include coordination of industry efforts to conserve energy. Task force reports are included for various categories of industries. Separate abstracts have been prepared for fifteen papers from this report.

26687 (CIPEC–88091888F) **Canadian Industry Program for energy conservation, 1987.** Canadian Industry Program for Energy Conservation, Ottawa, Ontario. 1988. 84p. (In French). (MICROLOG–89-00436; CE–02070). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C.

This report outlines the activities of a Canadian program, sponsored by government and administered by industry, for promoting and monitoring energy efficiency throughout Canadian industry. Program objectives include coordination of industry efforts to conserve energy. Task force reports are included for various categories of industries. Separate abstracts have been prepared for fifteen papers from this report.

26688 (CONF-8707139–) **Proceedings of the black liquor research program review fourth meeting held July 28–30, 1987.** Emerson, D.B.; Whitworth, B.A. Energetics, Inc., Columbia, MD (USA). Oct 1987. 413p. DOE Contract AC01-87CE40762. From 4. black liquor research program review meeting; Gaithersburg, MD, US; July 28, 1987. Order Number DE88004597/JAW. Available from NTIS, PC A18/MF A01 - OSTI; GPO Dep.

Research programs, presented at the black liquor review meeting are described. Research topics include the following: Cooperative Program in Kraft Recovery; Black Liquor Physical Properties; Viscosity of Strong Black Liquor; Ultrafiltration of Kraft Black Liquor; Molecular Weight Distribution of Kraft Lignin; Black Liquor Droplet Formation Project; Fundamental Studies of Black Liquor Combustion; Black Liquor Combustion Sensors; Flash X-ray Imagining of Black Liquor Sprays; Laser Induced Fluorescence For Process Control In The Pulp and Paper Industry; Recovery Boiler Optimization; Black Liquor Gasification and Use of the Products in Combined-Cycle Cogeneration; Black Liquor Steam Plasma Automization; The B and W Pyrosonic 2000R System; Monsteras Boiler Control System; and Cooperative Program Project Reviews. Individual projects are processed separately for the data bases.

26689 (EGG-EP–8340) **Solid-vapor complex compound chemical heat pumps for industrial applications: Final report.** Rockenfeller, U.; Kirol, L. EG and G Idaho, Inc., Idaho Falls, ID (USA); Rocky Research Corp., Boulder City, NV (USA). Oct 1988. 59p. DOE Contract AC07-76ID01570. Order Number DE89009743/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report briefly reviews complex compound chemistry and heat pump cycles using complex compounds. The proof-of-concept hardware is described and experimental results presented. Finally, the advanced heat exchanger test results and cost estimates are presented. Cost estimates and economic evaluations for complete complex compound heat pump systems are included. 9 refs., 34 figs., 4 tabs.

26690 (EPRI-CU–6334) **Design of industrial process refrigeration systems: Final report.** Witherell, W.D. Electric Power Research Inst., Palo Alto, CA (USA); Union Carbide Corp., South Charleston, WV (USA). Apr 1989. 230p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

When considering electric driven refrigeration compressors, proper integration with the process may result in reduced power consumption. However, the total utility situation must be considered when evaluating the compressor driver. Conversion from steam drivers to electric drivers may be more economical when considering proper process integration. These questions and various scenarios must be addressed in light of the total process requirements and constraints. During the last few years, Union Carbide has successfully applied ADVENT™ technology to several complex

processes that utilize refrigeration systems. In most cases the design of a complex refrigeration system in isolation (i.e., without considering process integration) generally results in nonoptimum refrigeration levels and excessive refrigeration consumption. By applying ADVENT™ Process Integration Technology to these nonoptimal designs, retrofit projects have emerged that clearly identify how to optimize the existing design with good project economics. 89 refs., 77 figs., 37 tabs.

26691 (NEI-DK–143) **Investigation of resistance to the drag of trawl nets, and of possible methods of counteracting it.** Hansen, K.; Wileman, D. Dansk Fiskeriteknologisk Inst., Hirtshals. Dec 1987. 65p. (In Danish). Order Number DE88757305/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

EFP-86.

The report concerns a project carried out by The Danish Institute for Fisheries Technology for the Danish Ministry of Energy were the aim is to investigate possible methods for reducing energy consumption in the trawl fishing industry. It has earlier been proved that if nets are constructed of thinner yarns and without knotting, resistance to the dragging force can be reduced, and that the size of the net's holes also have an influence in this respect. The object of this project is to examine which parameters influence the drag resistance, and the geometrical form of a net, when some sections, are changed out with others that have different parameters. It is also attempted to find out to what extent one can use energy saving materials without curtailing the fishing efficiency of the trawl nets. New, thinner garns which break less easily, the use of larger holes in the netting and of less knotting, the changing of the number of holes per section and of the form of the trawl net have been specifically examined. Mathematical methods for calculating drag resistance and the reduction of energy consumption according to the character of the suggested changes in the construction of the trawl nets are presented, and illustrated with figures and tables. (AB).

26692 (NEI-DK–144) **Evaluation of the energy saving and economical consequences of using various methods for reducing drag resistance in relation to trawl nets.** Hansen, K. Dansk Fiskeriteknologisk Inst., Hirtshals. Aug 1988. 13p. (In Danish). Order Number DE88757306/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

EFP-86.

In a previous report from The Danish Institute for Fisheries Technology ("Investigation of resistance to the frag of trawl nets, and of possible methods of cunteracting it") methods for reducing resistance to drag, and thus also reducing energy consumption in Danish trawl fishing, have been examined. Here a more detailed examination of the resulting energy saving potentials and the extent of the economical advantage is presented. (AB).

26693 (NEI-DK–147) **Energy-saving defrosting systems for blast chilling tunnels for pig carcasses and for other systems with similar defrosting requirements.** Clemmensen, J. Slagteriernes Forskningsinstitut, Roskilde (Denmark). Sep 1987. 21p. (In Danish). Order Number DE88757309/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

EFP-83.

The de-frosting process for air-coolers in blast chilling tunnels for pig carcasses requires to be fast, effective, reliable and to have a low energy consumption. The process also has to be able to be carried out automatically while the tunnel is in operation. A possible solution would be to remove the frost built-up on the leading edge of the evaporator mechanically. The frost layer will normally have a thickness of around 0.1 meters when the efficiency of the cooler has been reduced to approx. 60% due to reduced air circulation. Effective and reliable equipment for mechanical frost removal proved to be very expensive. An alternative system using a pre-evaporator (frost catcher) which was developed and tested at the same period in time was cheaper with better reliability and efficiency. The energy consumption is higher than for the mechanical system but running and maintenance costs were considerably lower. The price for an air-cooler based on a finned evaporator block for ammonia with a capacity of 45 kW (300 - 350 square meters) will go up by approx. 10% if it is equipped with a pre-evaporator (frost catcher). The energy consumption for de-frosting using an effective pre-evaporater system will be 0.1 kWh per chilled carcass (0.5 kg frost) agains 0.2 kWh for a traditional tunnel system.

26694 (NEI-DK–149) **Development of methods for reducing energy consumption in relation to the drying process involved in packaging production. Mathematical simulation with regard to the varnishing process.** Schlemmer, P.; Nielsen, K. Emballage- og Transportinstituttet, Skovlunde (Denmark). 1987. 54p. (In Danish). Order Number DE88757311/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

EFP-85.

Mathematical models for the drying process, derived from a study of the relevant literature, are presented. On the basis of these models the energy used by a varnishing machine used in a Danish packaging firm has been maximally reduced. It was discovered that energy consumption per produced substrat area unit fell in accordance with the rise in temperature. From these results it is deduced that packaging materials must be able to withstand high temperatures if energy is to be saved. Energy consumption is reduced in accordance with a fall in air speed at a rate of 30 m/s. Energy consumption decreased with increasing residue solvent content because of increasing production rates. Where choice of methods for recirculation of dyring air is concerned, a system where 36% of the energy is saved without changing the production rates is recommended. This would result in an annual saving of 150.000 Danish kroner. During the course of these experiments no attention was paid to the quality of the end product, which adds to the desirability of furhter investigations being performed. (AB) 12 refs.

26695 (NEI-DK–150) **Development of methods for reducing energy consumption in relation to the drying process involved in packaging production. Explanation of process technology in relation to flexography, serigraphy and photogravure including the laminating and varnishing processes which follow.** Schlemmer, P.; Nielsen, K. Emballage- og Transportinstituttet, Skovlunde (Denmark). 1985. 39p. (In Danish). Order Number DE88757312/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

EFP-85.

Three package printing processes, including the drying processes, are described, and it is concluded that "nip roll coating" could be used to help reduce overall energy consumption. It is also suggested that processes utilized in the Danish packaging industry need serious further investigation. (AB).

26696 (NP–9764530) **Development of low-waste secondary lead smelter based on accumulator battery scraps - desulfurization of accumulator pastes. Final report.** Lamm, K.F.; Poetzschke, M. Blei- und Silberhuette Braubach G.m.b.H. (Germany, F.R.); Metallgesellschaft A.G., Frankfurt am Main (Germany, F.R.). Metall-Laboratorium; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). May 1988. 120p. (In German). Order Number DE89764530/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

The Blei- und Silberhuette Braubach GmbH had a test facility for wet desulfurization of accumulator paste integrated in a spent accumulator treatment plant. This facility can handle approx. 10,000 tpy (= one third of the paste feed) according to the following equation: $PbSO_4 + Na_2CO_3 \rightarrow PbCO_3 + Na_2SO_4$. The facility was conceived as a bench-scale unit and was first optimized with respect to equipment and process details. Working together with RWTH Aachen, an optimum process routing was developed and the necessary data determined for computer-aided automatic addition of chemicals: pH value of the raw paste with adherent sulfuric acid (measured at the wet screen drum), density of the accumulator paste suspension (measured at the agitator vessel). Long-term tests proved the facility to be available at a rate of 70%, while the specific environmental conditions were met: Avoiding the typical SO_2 emissions from short rotary furnaces (sulfur collection efficiency approx. 90%), reducing slags by 70% and lead contents by 80% in an additive-free smelter process, process producing no waste water, converting the sulfur content of the spent accumulator battery (acid. lead sulfate) into an industrially useable chemical, energy saving. Paste desulfurization on an industrial scale can be realized. (orig.) With 2 refs., 12 figs.

26697 (NP–9764692) **Solidification, stabilisation and binding of organic pollutants from tips in brown coal dusts and bitumen.** Foerstner, U.; Khorasani, R.; Wienberg, R. (eds.). Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik. Jul 1988. 103p. (In German). Order Number DE89764692/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Berichte aus dem Arbeitsbereich Umweltschutztechnik der Technischen Universitaet Hamburg-Harburg.; no. 3.

Techniques for stabilisation, solidification and binding of pollutants are discussed as well as binders and fluxes. The materials were tested in sorption and desorption experiments.

26698 (OAF/AE–181-736) **Effects of decreasing the air temperature rise during the on cycle of a burner in a forced air downdraft tobacco stick-kiln. Preliminary report.** Van Hooren, D.L.; Columbus, M.J. Ontario Ministry of Agriculture and Food, Toronto (Canada). Agricultural Energy Centre. 1987. 19p. (MICROLOG–89-01133; CE–02575). Available from Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The volume of natural gas entering the burner of a downdraft stick-kiln was reduced to decrease the rise in air temperature during the on-cycle of the burner. The objective was to prevent green fixation and reddening of the tobacco in the upper tiers of the downdraft stick-kiln. Results indicated that the rise in air temperature was significantly reduced by decreasing the fuel input to the burner, but cured tobacco quality was not improved. As compared to cures in a control kiln, reducing the fuel input to the burner in the test kiln did not significantly affect fuel consumption in the first two cures, but 10% more fuel was consumed during the third cure. Monitoring will be continued during the 1987 curing season. 1 ref., 7 figs., 3 tabs.

26699 (OAF/AE–261-717) **Air-to-air heat exchanger for a mushroom farm. Final report.** Spieser, H. Ontario Ministry of Agriculture and Food, Toronto (Canada). Agricultural Energy Centre. 1987. 13p. (MICROLOG–89-01129; CE–02578). Available from Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Proper ventilation and temperature control is critical to provide the desired environment for continuous production in a commercial mushroom plant. During most of the year, the plant exhaust air temperature is in the range of 18^0C. Heat which is contained in this exhaust air can be easily recovered with a heat exchanger; this heat can be used to provide a part of the heating requirements of the mushroom plant. A large cross-flow, plate type heat exchanger was constructed and tested at Elgin Mushrooms Ltd. (364 ton/y of mushrooms). Air flow rates were calculated by determining air velocities and duct sizes. Cost savings for this heat exchanger are approximately $3700/y with an initial capital cost of about $7400. This heat exchanger has a pay-back period of about 2 years. It also provides a benefit during summer operation by cooling the incoming air by 2-3^0C. 3 figs., 3 tabs.

26700 (OAF/AE–290-731) **Self-regulating heating cable for heating a propagation bench.** Spieser, H. Ontario Ministry of Agriculture and Food, Toronto (Canada). Agricultural Energy Centre. 1987. 9p. (MICROLOG–89-01132; CE–02572). Available from Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Root zone heating results in quicker and more uniform seedling emergence as well as faster and better root development in cuttings. Various means have been used to supply this heat. Small diameter tubing carrying heated water has been used successfully as well as electric heating cables; conventional single conductor electric heating cables have experienced a short working life, due to cable burnout or control malfunctions. A new use for an existing product was felt to show promise. This involved using an electric heat tracing cable to supply root zone heat. This tracing cable is unique in that it has a self-regulating heat output. The operation of the heating cable is described. A propagation bench in a greenhouse was prepared for utilization of this self-regulated heating cable. The seedlings and cuttings responded as expected with bottom heat, with faster and better root development; the cable maintained the germination/propagation medium at the desired root zone temperature of about 30^0C. The cost of operating the cable was just under $0.10/m^2 of bench/d. 1 ref., 3 figs., 1 tab.

26701 (OAF/AED–88-6116) **Fan cycling and reversing. The orientation of tobacco leaves in racks in bulk tobacco kilns.** Van Hooren, D.L. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1988. 47p. (MICROLOG–89-01139; CE–02571). Available from Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Effects of cycling the fans of bulk kilns during tobacco curing were investigated. Tests were conducted in bulk kilns equipped with nine racks. Results indicated that fan cycling reduced electrical consumption and improved the average grade value of tobacco. However, fan cycling increased the curing time and fuel consumption. In a separate test, the benefits of curing tobacco racked with the leaves orientated in the butts down position was investigated. The comparative tests were also conducted in the nine rack bulk kilns. Results indicated that the average grade value of tobacco cured in the butts down position was significantly less than for tabacco cured in the traditional butts up position. Reversing the orientation of tobacco leaves in racks does not appear to affect the curing time and electrical consumption. Results were inconsistent as to whether fuel is conserved. 8 refs., 9 figs., 20 tabs.

26702 (OAF/AED–88-6507) **Sealing and insulating specific areas of bulk tobacco kilns.** Van Hooren, D.L. Ontario Ministry of Agriculture and Food, Delhi, ON (Canada). Agricultural Energy Centre. 1988. 19p. (MICROLOG–89-01138; CE–02577). Available from Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The energy and cost effectiveness of applying a 25 mm thickness of polyurethane foam to the roof, blower/burner wall, sheet metal above the blower/burner and base of five bulk kilns was evaluated. The cost of the polyurethane foam application was $600 per bulk kiln. As compared to five check kilns at the same site, a natural gas saving of 17% was realized. The simple payback period for the insulation retrofit would be about 7 curing seasons. If the bulk kilns had been fuelled by propane, the simple payback period would be about 4 curing seasons. 4 figs., 1 tab.

26703 (PB–89-150593/XAB) **Energy saving device: AP-Fin (Aperture Fin).** Koshiba, Y.; Shirose, Y. Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan). 1988. 6p. Available from NTIS, PC EE04/MF A01.

Text in Japanese; Included in IHI Engineering Review, Vol. 28, No. 6, 398-403(1988).

The energy-saving device named AP-Fin (Aperture Fin) was developed to improve the propulsive performance by reducing the rotational energy loss behind propeller, and not impairing the superiority of the optimized stern and propeller. AP-Fin is a simple curved plate fitted to the upper part of the propeller aperture and its features are easy design and construction, low cost, and wide applicability. Series model tests systematically varying skew and length of AP-Fin are performed to study the effects on resistance, interaction, flow field and rudder force. As a result of these experiments, power-saving effect of AP-Fin was confirmed to be about 4% in full load condition and approximately 2% in ballast condition for VLCC. The semicontainer ship, the first full-scale vessel adopting AP-Fin, will be in service before the end of 1988.

26704 (PB–89-162143/XAB) **Gas-turbine cogeneration system with steam injection. Annual report, October 1987-September 1988.** Cain, W.G. Mechanical Technology, Inc., Latham, NY (USA). 4 Nov 1988. 62p. (MTI–89TR2). Available from NTIS, PC A04/MF A01.

A gas-turbine topping-cycle cogeneration system was developed to specifically meet the needs of industrial cogenerators in the 2-10

MW(sub e) range. The steam-injected cogeneration system was installed in the GM/Hydramatic plant in Warren, Michigan. Operation of the cogeneration system commenced in June of 1988. The cogeneration system was installed with sufficient instrumentation to allow monitoring of the performance for at least a one-year period. Two areas of interest are the effects of steam injection on the NOx and carbon monoxide emission levels and the performance of the passive feedwater cleanup system.

26705 (PB–89-163018/XAB) **Characterization of Non-RCRA (Resource Recovery and Conservation Act) special waste. Final report.** Frerichs, W.W. Illinois Dept. of Energy and Natural Resources, Springfield, IL (USA). Jan 1989. 134p. Available from NTIS, PC A07/MF A01.

The research study is a continuation of the earlier research directed at developing a methodology to assess degree of hazard of waste streams generated by Illinois industries. Previous studies developed a degree of hazard categorization system which can assign a degree of hazard ranking to a waste stream if sufficient data on the waste stream are available. The study developed data on a statistically valid sample of 1984 Non-RCRA special waste streams sufficient to assess the degree of hazard using the methodology already developed. These data were obtained primarily from Illinois EPA files. Information available with Illinois EPA on individual waste streams was generally found to be adequate to make assessments on the fate of these wastes. In addition to compiling data on representative sample of waste streams, a profile of the sample of waste streams examined is given as well as recommendations on proceeding with regulatory proposals to incorporate degree of hazard evaluation methodology for incorporation into Illinois Environmental Regulations.

26706 (SBI-Landbrugsbyggeri–71) **Measurements of energy consumption in greenhouse nurseries heated with heavy fuel oil.** Rasmussen, H.C.; Stroem, J.S. Statens Byggeforskningsinstitut, Hoersholm (Denmark). 1988. 44p. (In Danish). Available from Statens Byggeforskningsinstitut, Postboks 119, DK-2970 Hoersholm.

EFP-81, EFP-82, EFP-83.

As part of the research project "Energy saving and use of low quality energy in greenhouse nurseries", funded by the Danish Ministry of Energy and Ministry of Agriculture, reliability and accuracy of continuous registration of heavy fuel oil consumption in nurseries were studied. The equipment selected for investigation was tank level meters, volume flow meters, a mass flow meter, running time meters and start counters. The mass flow meter was selected as instrument for internal calibration and was therefore compared to external references. The oil quality was quite constant. The density was 991 $\pm$ 1 kg/m3 at 15 deg. C. Lower heat of combustion was 40.1 $\pm$. 1 MJ/kg which was slightly higher than the standard value specified by the oil company. The temperature of the oil in the ring pipe was constant at 67 deg. C $\pm$ 2 deg. C making it acceptable to assume constant density. The investigation showed that there were particles able to stop volume flow meters operating with small mechanical tolerances. Oil sludge was not found to interfere with the measurements. The mass flow meter appeared to have an uncertainty of less than $\pm$1% in an operational range of 60-300 kg/h when compared to external references. The oval meter was sensitive to particles in the oil and is therefore not suitable in greenhouse nurseries. The semi-rotary piston was however reliable with an accuracy for the signal of $\pm$1.7% of the actual flow within the range 80-170 kg/h. It was easy to calibrate and is considered the better of the two for nursery applications. For automatic registration of oil level in the storage tank, a piezoelectric end a pressuredifference sensor were tested. Neither of them block the oil supply to the burner in case of failure. (AB).

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Refer also to citation(s) 26415, 26416, 26621, 26697, 27786

26707 (MLA–11553) **Study on resource recovery in the Greater Moncton area.** Wiggin, M. MacLaren Atlantic Ltd., Moncton, NB (Canada). 1979. vp. (CE–02544). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The main objectives of this study were to investigate the existing recovery activities in the Greater Moncton area (pop. ca 78,600) and to evaluate the possibilities of new systems development or of improvements to existing programs. The resource potentials and the markets for gas and newsprint are evaluated. Glass collection is discussed, including the Ahlstrom collection program, individual collectors, and both exchange centres. The potential for expanded glass recovery is difficult to establish, due to unpredictable public participation. Newsprint collection is also discussed. The economics of a collection program are examined and recommendations are made for its implementation. 2 figs., 5 tabs.

26708 (NEI-DK–148) **Long-time effects of meter adaption in Helsinge.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Risager, K.; Munk Pedersen, J. Danske Fjernvarmevaerkers Forening, Kolding (Denmark); Cowiconsult Raadgivende Ingenioerer A/S, Virum (Denmark). Dec 1988. 79p. (In Danish). Order Number DE88757310/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme.

The energy pricing policy in a DH system in the town of Helsinge in North Zealand, Denmark, was changed in 1981/82, when the tariff principle was altered from a policy of charging consumers on the basis of water volume (m^3) measurement to charging on the basis of the measurement of energy consumption (MWh). The meters at the consumers were converted to correspond with this new policy. The report describes the experience gained during a period from three years before the implementation to six years after. According to the previous tariff structure the consumers were charged for their accumulated water flow, calculated as a combination of a fixed rate based on the number and size of radiators in the consumer's installation and a consumption dependent rate based on the measured water volume. Since the change of the tariff principle in 1981/82 the consumers have been charged for their energy consumption, calculated as a fixed rate based on the heated volume of the building and a varying rate based on the measured energy consumption. The new tariff principle has made it possible to decrease the supply temperature from 90 deg. C to 75 deg. C. The water flow in the DH network can be reduced by approximately 50% during the summer period due to the elimination of a large number of by-passes. The heat loss in the DH network (calculated as the difference between the energy produced at the boiler plant and the energy sale to the consumers) is reduced by approximately 50%. Consumers connected to the DH system after the implementation of the new tariff principle have a significantly lower cooling. (AB).

26709 (NEI-DK–153) **Project no. 40 in the field of district heating. Testing method for casing thickness of preinsulated district heating pipes.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Hansen, K.E.; Hoej, N.P. Hoejlund Rasmussen (B.) Raadgivende Civilingenioerer, Copenhagen (Denmark). Jan 1989. 88p. (In Danish). Order Number DE88757315/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme.

The investigation evaluates the resistance of casing to penetration of a subject (eg. stones). Tests have been performed on cones with apex angles of 15 and 45 degrees, and on a mandrel with a diameter of 10mm. Results are expressed by the maximum force measured during penetration. Penetration velocities were 500 mm/min., 100mm./min. and 0.1 mmm/min. Casings with a thickness of 2.0mm-10.6mm, and diameters of 110mm and 125mm respectively, have been tested, and penetration tests were made on a plane plate. It is concluded that the greatest stresses are caused by a concentrated load and that resistance is proportionate to casing thickness. (Some material qualities for PUR cellular plastic and PEH casings are described). It has not been possible to find a connection between a casing's diameter and its resistance, but it is concluded that the strenght may be proportional to the decimal logarithm for the load velocity. Resistance to penetration of the mandrel (diam.10mm) is 278 X t (t=thickness of casing), of the cone

45 deg. is 145.7 x t and of the cone 15 deg. is 65.9 x t. - where the load velocity is 0.1mm/min. The strength of the casing is evaluated in proportion to the net weight of a preinsulated district heating pipe and to the influence under foaming. It appears that with a maximum very sharp-8mm-150 cone stone there is a risk of damage to the thinnest casing (2.2mm-3mm). If no stones appear with a cone sharper than 45 deg., there will be no risk from sizes below 8mm. However, safety evaluations should take special account of the casing's temperature. (AB).

26710 (ORNL/Sub–87-56553/1) **Expedient emergency sanitation measures: Final report, October 1986–October 1988.** Gutmanis, I.; Chester, C.V. Oak Ridge National Lab., TN (USA); Sterling Hobe Corp., Washington, DC (USA). Apr 1989. 86p. DOE Contract AC05-84OR21400. Order Number DE89010310/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This guide is designed as an annotated checklist to aid local officials who are responsible for maintaining or restoring adequate sanitation in a widespread emergency. In the event of a major earthquake or nuclear attack, sewage collection and treatment systems, electric power and water treatment and distribution systems may be damaged or destroyed. Loss of sanitary sewage systems and water treatment capability sharply increases risk of the spread of disease among the survivors. The guide includes details of expedient methods of water disinfection, septic waste disposal, and disease vector control. Information on obtaining and using chemicals for these purposes is included. 3 tabs.

26711 (PB–89-161491/XAB) **Fractionation of mutagens from municipal sludge and waste water.** Wright, C.W.; Stewart, D.L.; Weimer, W.C. Pacific Northwest Lab., Richland, WA (USA). Feb 1989. 69p. Available from NTIS, PC A04/MF A01.

There are potential environmental concerns from the disposal of municipal waste-water effluents and sewage-treatment-plant sludges. The report summarizes the microbial mutagenic evaluation of 13 sewage-sludge samples from various locations in Texas and Washington state. The sewage sludge samples were air-dried followed by sequential Soxhlet extraction with pentane, methylene chloride, and methanol. The organic extracts from three of the samples were further fractionated by normal phase high-pressure liquid chromatography (HPLC). The obtained extracts and fractions were bioassayed for microbial mutagenic response using the standard histidine reversion assay with Salmonella typhimurium strains TA98 and TA100, both with and without S9 metabolic activation. Extracts and fractions were chemically analyzed by high resolution gas chromatography (GC) using a variety of element-specific detectors, gas chromatography/mass spectrometry (GC/MS), and liquid chromatography/mass spectrometry (LC/MS).

26712 (PB–89-165369/XAB) **District heating/feasibility study for Jamestown, New York. Phase two. Final report.** Oliker, I. Burns and Roe, Inc., Oradell, NJ (USA). Apr 1986. 238p. Available from NTIS, PC A11/MF A01.

See also PB–83-247023.

This report details an investigation to implement district heating in Jamestown, New York. It is a technical and economic feasibility study of a hot-water district-heating system, using a municipal electric plant as the heat source and the downtown area as a source for customers. As a result of the project, the City of Jamestown built a district-heating system that was a service to four customers in 1984 and expanded to 14 customers in 1985. The City expects it to grow in 1986 and beyond. Customers are realizing a 20 to 30% savings in heating costs. The municipal electric plant burns coal and the system so far has displaced the equivalent of 1 million gallons of oil per year.

26713 (SAE–1944-1-1-1) **Edmonton district heating feasibility study. Interim report.** Mears, D.D. Stanley Associates Engineering Ltd., Edmonton, Alberta (Canada). 1979. 5p. (CE–02554). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The study was undertaken to investigate the feasibility of extracting heat from Rossdale Generating Plant and distributing it, using hot water or steam as the medium, to buildings in the downtown core of Edmonton. The study begun in January 1979 and includes consideration of modifications to the generating units in Rossdale, the sizing and location of the distribution network, the heat demands, and the transmission medium and temperature. This interim report presents information on size of the study area, and collection of such data as temperature of the area, types and sizes of buildings and their heating demand, generating plant data, and a preliminary analysis of the heat available and required. The results of this preliminary analysis indicate that a district heating system is technically feasible.

3209 Education and Public Relations

Refer also to citation(s) 26622, 26655

26714 (CRC–1977) **A study of the Canadian public's attitudes toward the energy situation in Canada. Wave 3. A quantitative trend study conducted in selected major urban centres in Canada, of the attitudes of both men and woman toward the subject of energy.** Centre de Recherches Contemporaines Ltd., Montreal, Quebec (Canada). 1977. vp. (CE–02562). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study, in general, attempts to measure: the extent to which the Canadian public regards energy as a problem in relation to other issues facing Canada today; the extent and manner in which the public can help to alleviate the problem; the public's opinion on what role the government should play in solving the energy problem; and whether there has been any shift in opinions, in relation to the above areas, over the last 12 months. The sampling, field work, and statistical significance of the results are discussed. The topics of the opinion poll were: problems facing Canada today; energy as a possible area of concern to Canadians; the importance and likelihood of energy conservation by individuals; the role of government in the energy situation; insulation and energy conservation; effects of the energy situation on the Canadian public; and energy conservation efforts by Canadians. The questionnaire administered is included. 44 tabs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 26298, 26719, 26720

26715 (AD-A–202999/9/XAB) **Effect of platinum catalysts on propane oxidation at elevated pressure.** Lee, W.; Litzinger, T.A.; Santavicca, D.A. Pennsylvania State Univ., University Park, PA (USA). Davey Lab. 1988. 11p. Available from NTIS, PC A03/MF A01.

The potential for catalytically enhanced ignition in low-heat rejection diesel engines was experimentally studied under engine-simulated conditions in a high-pressure chemical flow reactor. Results are presented for propane oxidation on platinum at 6 and 10 atmospheres, at temperatures from 800 to 1050K, and at equivalence ratios from 0.5 to 4.0. For turbulent transport rates typical of those in an engine, as much as 20% of the fuel was found to react on the catalyst before the onset of the gas-phase ignition reactions. Depending on the adiabaticity of the combustion-chamber walls, this could lead to significant thermal enhancement of the gas-phase ignition process. Evidence of chemical enhancement was also observed, at 10 atm under very fuel-rich conditions, in terms of a change in the concentration and distribution of the hydrocarbon intermediate species. Possible mechanisms for the observed chemical enhancement due to surface generated species are discussed.

26716 (DOE/AL/33183–T11) **Multidimensional modeling of convective heat transfer with application to I.C. engines: Technical progress report.** Jennings, M.J.; Morel, T. Ricardo-ITI, Inc., Westmont, IL (USA). 21 Apr 1989. 21p. DOE Contract AC04-86AL33183. Order Number DE89010651/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to develop a more comprehensive understanding of the convective heat transfer process in complex, unsteady turbulent reacting flows, typical of those which occur in internal combustion engines. The specific area of research is the representation of heat transfer in detailed multi-dimensional Navier-Stokes models, and modeling of turbulent transport mechanisms. The detailed tasks include a review of relevant prior work. Based on this review, and original work done under this contract, several modeling approaches will be formulated and further studied and tested. The tests will be carried out on flow cases which have relevance to engine flows, and for which reliable experimental data exist. Such data will be sought and identified. The analytical studies will lead to the determination of the best modeling approaches to be used for heat transfer simulation in internal combustion engines. Following that, a detailed study will be carried out of spatial and temporal heat flux distribution in a representative engine. This will be complemented by a parametric study of engine heat transfer dependence on intake flow details, combustion chamber geometry, engine speed and engine load. 4 refs., 10 figs.

3303 Electric-powered Systems

26717 (EPRI-CU-6329) **Evaluation of electric vehicle battery systems through in-vehicle testing: Third annual report, April 1989.** Blickwedel, T.W.; Thomas, W.A.; Whitehead, G.D. Electric Power Research Inst., Palo Alto, CA (USA); Electrotek Concepts, Inc., Chattanooga, TN (USA). Apr 1989. 70p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This third annual summary report documents the performance from October 1986 through September 1987 of the Tennessee Valley Authority's ongoing project to evaluate near-term electric vehicle traction battery packs. Detailed test procedures and test data are available from EPRI in an informal data report. The purpose of this field test activity is to provide an impartial life evaluation and comparison of the performance of various battery systems in a real-world operating environment. Testing includes initial acceptance testing of battery components and systems, daily in-vehicle operation of the batteries, monthly in-vehicle driving range tests, and periodic static (constant current) discharge tests under computer control. This year's report gives the final results on a NiZn, NiCd, Gel Cell, and two lead-acid battery packs. Specific energy and monthly driving ranges (SAE J227a "C" cycle and 35 mi/h constant speed cycles) are maintained throughout battery life. Vehicle range test data is analyzed statistically and variable conditions are normalized for comparative purposes. Battery modules in the pack are replaced when their measured ampere-hour capacity at a fixed discharge rate drops to 60 percent of the manufacturer's rated value. The life of a test battery pack is terminated when 25 percent of the modules in the pack have been replaced or require replacement. 26 figs., 8 tabs.

26718 (OTC-EV/88/02) **Electric vans in courier service: second six-month progress report.** Hsu, W.; Duncan, J. Ontario Ministry of Transportation and Communications, Ottawa, ON (Canada). 1988. 73p. (MICROLOG-89-01617). Available from Ontario Ministry of Transportation and Communications, Research and Development Branch, 1201 Wilson Ave., Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report summarizes the second 6-month operation of 2 electric vans in courier service between the Queen's Park complex and the Ministry of Transportation in Downsview. The operational statistics for the cumulative 12-month period from May 14, 1986 to May 13, 1987 were: a total driving distance of 39,702 km was logged by the 2 electric vans; EV11 was in full-day service for 176 days out of 249 days and EV12 for 163 days; the mean vehicle daily driving distance was 79-72 km; the electricity consumption was 0.50 kWh/km and the electricity cost was 1.90 cent/km; the operational cost, which includes electricity, heater fuel, battery water, vehicle maintenance parts, and labour, was 10.59 cents/km. 2 refs., 5 figs., 15 tabs.

3304 Hybrid Systems

Refer also to citation(s) 26717

3307 Emission Control

Refer also to citation(s) 26607, 26704

26719 (PB-89-158208/XAB) **Diesel particulate extract study. Part 2.** Coordinating Research Council, Inc., Atlanta, GA (USA). Aug 1988. 72p. (CRC-562). Available from NTIS, PC A04/MF A01.

See also PB-81-221251.

Through cooperative research, the Chemical Characterization Panel of the CRC-APRAC Program Group on Composition of Diesel Exhaust has worked to improve characterization of unregulated diesel emissions and to validate chemical analysis methods for measuring diesel-exhaust constituents. In Part I, the Panel dealt with extraction of the organic fraction from diesel particulate matter, including investigation of various solvents and laboratory techniques. Part II of the CRC-APRAC Diesel Particulate Extract Study expanded the previous research to heavy-duty diesel engines operating under transient test conditions of the U.S. EPA Heavy-Duty Diesel Certification Test Procedures. The Panel extended its extraction and characterization studies to include samples from the Engine Manufacturers Association (EMA) and the U.S. EPA Mobile Sources Laboratory round-robin program to determine inter-laboratory and test-to-test variability of heavy-duty diesel-engine exhaust emissions for the Transient Test and 13-Mode Steady-State Cycle Tests. Six heavy-duty diesel engines, typical of production engines in the early 1980's with rated power ranging from 150 to 285 kW (200-380 hp) were used in the round-robin program.

26720 (PB-89-164271/XAB) **User's guide to MOBILE4 (Mobile Source Emission Factor Model). Technical report.** Environmental Protection Agency, Ann Arbor, MI (USA). Feb 1989. 195p. (EPA/AA/TEB-89/01). Available from NTIS, PC A09/MF A01.

Supersedes PB-84-213974.

This document is the User's Guide to MOBILE4. MOBILE4 is a computer program that calculates emission factors for hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) from gasoline-fueled and diesel highway motor vehicles. The program uses the calculation procedures and emission factors presented in Compilation of Air Pollutant Emission Factors: Highway Mobile Sources (AP-42 Fourth Edition, September 1985). MOBILE4 calculates emission factors for eight individual vehicle types in two regions of the country. MOBILE4 emission estimates depend on various conditions such as ambient temperature, speed, and mileage accrual rates. MOBILE4 supersedes MOBILE3.

3308 Alternative Fuels

Refer also to citation(s) 26420

26721 (AD-A-202471/9/XAB) **CRC (Coordinating Research Council) hot-start and driveaway driveability program at high and intermediate temperatures using gasoline-alcohol blends.** Coordinating Research Council, Inc., Atlanta, GA (USA). Aug 1988. 222p. (CRC-555). Available from NTIS, PC A10/MF A01.

A cooperative CRC test program was conducted at Failure Analysis Associates Test Track in Phoenix, Arizona, from September 4 through October 4, 1985. The program investigated the hot-start driveability of thirteen 1985 model vehicles with eight hydrocarbon-alcohol blends and two hydrocarbon-only gasolines at nominal ambient temperatures of 90 and 70 F. The driveability procedure was modified to emphasize conditions that may cause fuel foaming. Carburetted, throttle-body-injected (TBI), port-fuel-injected (PFI), and port-fuel-injected turbocharged fuel systems were represented in the vehicle fleet. Ambient temperature effects were highly significant for carburetted and throttle-body-injected vehicle fuel-metering systems and for the total fleet. Carburetted vehicles were more sensitive to fuel properties and ambient conditions than fuel-injected vehicles.

35 ARMS CONTROL

3501 Policy, Negotiations, and Legislation

26722 (AD-A-202639/1/XAB) **Changing face of Soviet strategy. Research report.** Kaufmann, J.W. Air War Coll., Maxwell AFB,

AL (USA). May 1988. 132p. (AU-AWC–88-146). Available from NTIS, PC A07/MF A01.

The Soviet Union is our main competitor for power and influence in the world. It has the power to destroy our society, as we know it, within hours. To prevent this from happening, we must understand the Soviet's political and military objectives and strategy relating to global conflict. Evidence suggests that the Soviets may have made, or may be in the process of making, serious revisions in their global nuclear and conventional strategy and doctrine. This paper briefly traces the history of Soviet military strategy and doctrine since World War II and presents evidence that they are at a crossroad in their strategic thinking. They are currently weighing the economic, political, and military consequences of continuing a confrontational, offensive nuclear warfighting strategy, doctrine, and force posture and are considering a change to a less-threatening and affordable posture. A brief look at their reaction to President Reagan's Strategic Defense Initiative and General Secretary Gorbachev's latest arms control initiatives reinforces the argument that a shift in Soviet strategy may take place in the near future if America lets it happen.

26723 (AD-A–202641/7/XAB) **Arms control: the common denominator in superpower relations. Research report.** Drobot, N.J. Air War Coll., Maxwell AFB, AL (USA). Apr 1988. 48p. Available from NTIS, PC A03/MF A01.

The purpose of this paper is to highlight arms control as a mutually shared interest in superpower relations. Chapter I addresses US foreign policy vis-a-vis the USSR and vice versa, and focuses on current superpower national interests. Today, the USSR is preoccupied with economic development and is providing the US with unique opportunities in arms-control concessions. The US is concerned with stimulating its economy as well and in reducing federal budget deficits. Chapter II focuses on the specifics of the Intermediate-Range Nuclear Force (INF) Treaty. A review of the background since 1977 leading up to the treaty is presented followed by specific terms of the treaty to include the types pf missile systems, timetables and methods of elimination, and the mutual-verification scenario. Personnel requirements to implement the treaty are also presented. Chapter III addresses the impact of the INF treaty on NATO doctrine and force employment. Current criticisms of the treaty that relate to the resulting military balance in Europe and US commitment to NATO are presented. US/NATO and Soviet/Warsaw Pact thinking on such areas as defense sufficiency, modernization, and future arms-control agreements is also covered.

26724 (AD-A–202730/8/XAB) **SDI (Strategic Defense Initiative) and national security policy. Research report.** Davis, R.W. Air War Coll., Maxwell AFB, AL (USA). Apr 1988. 109p. Available from NTIS, PC A06/MF A01.

The paper attempts to answer the fundamental question of Can SDI make a significant contribution to US national security. It uses as its evaluation criteria historical arms-control measurements of stability, reduction in the probability of war, reduction in the consequences of war, economic benefits, and political benefits. A historical discussion of US nuclear strategy development along with Soviet thinking is provided as a backdrop to set the stage for an analysis of the reasons for President Reagan's March 1983 speech. The objectives of SDI are discussed along with the major concerns expressed by the program critics. Using the evaluation criteria defined above, the author analyzes SDI potential position in a long-term integrated national strategy that includes arms control and competitive strategies.

36 MATERIALS

26725 (DFVLR-Mitt.–89-02) **Materials and structures for 2000 and beyond. An attempted forecast.** Winter, C.J.; Mailaender, M. Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.). 1989. 87p. (In German). Order Number DE89764552/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The future can never be clearly perceived. Attempted predictions provide no more but vague visions. Still, the planning of future activities is an indispensable requisite for meaningful research which the Materials and Structures Department of the DLR addressed in closed session on Oct 21-22, 1988, in Ueberlingen. The prime motivations were the change of directorships in four of its five institutes within the next seven years, and the lapse of a decade since the last similar planning attempt. Emphasis was placed on an assessment of the present long-term goals of the institutes and the department, and on a forecast of expected developments in the next 15 yeras. The potential consequences on the direction and methodology of current work, and on the organization of the institutes and the department, were anticipated. Based on an evaluation of pertinent considerations the Institutes for Aeroelasticity, Advanced Design and Manufacturing Technology, Space Simulation, Structural Mechanics and Materials Research, after intensive discussions, formulated their individual views of future challenges. The departmental secretariat attempted to draw conclusions and to propose guidelines for their implementation. (orig.) With 1 tab., 13 figs.

3601 Metals and Alloys

Refer also to citation(s) 26488, 26488, 26488, 26505, 26519, 26531, 26763, 26773, 26774, 26796, 26829, 26904, 26904, 27695, 27696, 27707

26726 (AD-A–202591/4/XAB) **Chemical vapor synthesis of niobium aluminides. Final technical report, August 1987-April 1988.** Norman, J.H.; Reynolds, G.H. MSNW, Inc., San Marcos, CA (USA). Oct 1988. 56p. Available from NTIS, PC A04/MF A01.

Phase I experiments to produce thin films of various niobium aluminide compositions by chemical vapor deposition and supporting process models are described.

26727 (AD-A–202652/4/XAB) **Effects of loading history and closure of the fatigue characteristics of heat-treated Ti-6Al-2Sn-4Zr-6Mo. Master's thesis.** Perez, J.A. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 144p. (AFIT/GAE/AA–88D-30). Available from NTIS, PC A07/MF A01.

The purpose of this study was to investigate the effects of loading history and crack closure on the fatigue-threshold properties of additionally heat treated Ti-6Al-2Sn-4Zr-6Mo. The crack-closure measurements taken by a clip gage, strain gage mounted on the back face (BFS), and laser interferometric displacement gage (IDG) were compared. Also, the effects of heat treatment on the fatigue behavior of Ti 6246 were discussed. Three tests were run using compact test specimens at a test frequency of 30 hz. The results from these tests indicated that additionally heat treating Ti 6246 did improve its fatigue threshold characteristics.

26728 (AD-A–202952/8/XAB) **Sintering-atmosphere effects on tensile properties of heavy alloys.** Bose, A.; German, R.M. Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering. Oct 1988. 11p. Available from NTIS, PC A03/MF A01.

Pub. in Metallurgical Transactions A, Vol. 19A, 2467-2476(Oct 1988).

The sintering atmosphere has a direct bearing on the residual porosity which in turn has a strong negative influence on the tensile properties of tungsten-nickel-iron heavy alloys. This investigation uses various sintering atmospheres to understand pore formation, densification, microstructure, and tensile properties of heavy alloys with tungsten contents ranging from 88 to 97 wt pct. Pore formation when sintering in a dry-hydrogen atmosphere is linked to water vapor generation and its entrapment in pores. A hydrogen dew-point effect is associated with solution-reprecipitation of tungsten during liquid-phase sintering. The beneficial effect of vacuum sintering was analyzed in terms of removal of the gases before pore closure. Property degradation during long-time vacuum sintering is attributed to preferential matrix vaporization. The negative effect of long sintering times in dry hydrogen is attributed to pore coarsening, which is removed by a three-stage sintering atmosphere treatment.

26729 (AD-A–203093/0/XAB) **Basic studies of ion mixing. Final report.** Nicolet, M.A. California Inst. of Tech., Pasadena, CA (USA). 16 Nov 1988. 13p. Available from NTIS, PC A03/MF A01.

The objective was to elucidate mechanisms of atomic mixing induced by ions with masses greater than 25 amu and energies between 50 and 500 keV. Specifically, the intent was to identify systematic trends that would reveal the nature of the main parameters

that affect atomic rearrangements generated by ion irradiation. In addition, the relationship that might exist between the mechanisms of ion mixing and of thermal processing was to be explored. Metallic systems were to be emphasized. The approach was to choose samples and parameters of irradiation in such a way that the complexity of the results was minimized. The idea was that limiting cases would thereby be established for which one mechanism is dominant. Consequently, experiments at low temperatures were pursued to investigate processes that are independent of temperature. Irradiations at elevated temperatures were employed to investigate the correlation between ion mixing and thermal processing.

26730 (AD-A-203727/3/XAB) **Magnetic properties of nano-heterogeneous amorphous, thin films. Annual technical report, 1 June 1987-31 May 1988.** Walser, R.M. Texas Univ., Austin, TX (USA). Dept. of Electrical and Computer Engineering. 20 Dec 1988. 11p. Available from NTIS, PC A03/MF A01.

Substantial progress was made in processing nano-heterogeneous, amorphous thin films with attractive magnetic properties. Work was concentrated on two categories of sputtered thin films; (1) soft magnetic, CoB and CoNbZr alloy thin films, and (2) magneto-optical, compositionally modulated Gd/Co multilayer thin films. We are attempting to understand and control the nanoscale heterogeneous structures of these films for application to, respectively, thin film magnetic recording heads, and magneto-optical recording.

26731 (AD-A-203734/9/XAB) **Microstructural and phase characterization of RST A1-Ti-X alloys. Final report, 1 October 1987-1 July 1988.** Frazier, W.E.; Thompson, J.J. Naval Air Development Center, Warminster, PA (USA). Air Vehicle and Crew Systems Technology Dept. 1 Jul 1988. 19p. (NADC-88007-60). Available from NTIS, PC A03/MF A01.

Powder Metallurgy A1-4 wt.% Ti and A1-6 wt.% Ti alloys have demonstrated potential for elevated temperature (200-300 C) aircraft applications. These materials derive their excellent strength, ductility, and creep resistance from their fine-grain structure, oxide dispersion, and A1Ti intermetallics. Inert gas atomization and mechanical alloying have been used to produce the binary alloy powders; however, because of the large solidification range (1200-665 C) large quantities of primary $A1_3Ti$ were produced. In this study A1-Ti, A1-TiCe, and A1-Ti-V alloy powders were produced by melt spinning. The alloys were fully characterized in order to assess the effect of composition and processing conditions on microstructure and phase stability. Optical and electron microscopy was used to study the morphology and distribution of second phase disperoids. X-ray diffraction, differential scanning calorimetry (DSC), and selected area electron diffraction (SAD) techniques were used to establish the crystallography of the phases present. The microstructure of the melt spun A1-Ti-X alloys have a higher volume fraction of finely dispersed submicron aluminides than did the previously studied inert gas atomized alloy powders. The major phases identified included A1 (fcc), $A1_3Ti$(14/mmm), and $A1_3Ti$ (14/mmm).

26732 (AGA-9010604) **A mechanics based analysis of stress corrosion cracking of line-pipe steel in a carbonate-bicarbonate environment: Topical report.** Leis, B.N.; Walsh, W.J. American Gas Association, Inc., Arlington, VA (USA); Battelle Columbus Div., OH (USA). Aug 1988. 45p. Available from OSTI - American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 $50.00.

A model for SCC crack initiation and early growth has been developed and used to rationalize the SCC behavior observed in tapered-tension tests (TTT) of line-pipe steels that have been tested under high maximum stress levels with a small amplitude controlled cyclic component in a carbonate-bicarbonate environment. Results presented indicate a good correlation between the observed susceptibility and that predicted with the model. Attention has focussed on modeling SCC thresholds and growth behavior so that data developed under laboratory conditions can be adapted to assess field cracking situations. The model developed and validated deals with SCC threshold behavior and growth of cracks up to about 0.020 inch deep. In its final form the model will be useful in making choices regarding SCC resistant steels and decisions on the growth rate of SCC cracks prior to the formation of a crack whose growth is controlled by fracture mechanics. 26 refs., 11 figs.

26733 (BMU-1988-202) **Fracture mechanics for HTGR-safety evaluation. Integrity evaluation of the steam cycle of a HTGR electric power plant. Final report.** Roedig, M.; Pfaffelhuber, M.; Klomfass, J.; Schubert, F.; Nickel, H. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). 31 Dec 1987. 111p. (In German). Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten.

Investigations on the fracture mechanics behaviour of X10 NiCrAlTi 32 20 (Alloy 800) have been performed at a temperature of 550^{0}C. These investigations were part of the safety philosophy for the steam cycle of a power producing HTGR-plant. Emphasis was laid on the demonstration of the transferability of creep and fatigue crack growth laws. The fatigue crack growth data measured with several standard specimens are in good agreement. So it can be assumed, that a description of the fatigue crack growth by means of the linear-elastic parameter is valid. In addition an experiment was performed with a thick walled tube in four point bending, containing a non through wall circumferential crack. By several approximation methods a conservative estimation of the fatigue crack growth in this tube is possible. The creep crack growth in standard specimens is well described by an energy rate integral. The linear elastic description gives a large scatter of data, hence it seems not to be a valid parameter for the description of the creep crack growth. In thin walled heat exchanger tubes with circumferential cracks in tension, the fatigue crack growth very roughly can be described by means of the parameter. This is valid although the formal suppositions are not fulfilled. The failure stress for these tubes in tensile loading is described conservatively by means of the Battelle formula.

26734 (CANMET-PMRL-86-11-TR) **Analysis of deposits, scales and sub-scales on alloys exposed in the Point Tupper atmospheric fluidized bed combustor.** Hindam, H.; Packwood, R.; Gilmour, J.B. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario (Canada). 1986. 44p. (In English and French). (MICROLOG-89-01071). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A wide range of commercial Fe-based alloys (ferritic and austentic) were exposed in an atmospheric fluidized bed combustor (AFBC) utilizing a S-Containing coal and a limestone sorbent. This report describes the morphology and composition of the deposits, scales and sub-scales formed on selected samples of the alloys after up to three 1000 h runs. 4 refs., 24 figs., 4 tabs.

26735 (CANMET-PMRL-87-8-TR) **Examination of corrosion probes from a laboratory-scale circulating fluidized bed combustor.** Gilmour, J.B. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario (Canada). 1987. 26p. (In English and French). (MICROLOG-89-00976). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Six Type 304 stainless steel tubes that had been exposed in the combustion zone of a laboratory-scale circulating fluidized bed combustor in the Mineral Sciences Laboratory were examined for corrosive attack. All tubes had been exposed for about 125 h at 850^{0}C, three while the combustor was fueled with vanadium-containing Syncrude coke, and three while it was fueled with Minto coal. Metallographic examination showed that all tubes had suffered intergranular sulphidation/oxidation on the bottoms where deposits formed during operation. The area and depth of attack were similar on all tubes. The tops of all tubes had negligible attack. The morphology of the intergranular attack was similar to that observed on austenitic alloys exposed in the bed of bubbling-bed atmospheric fluidized bed combustors. There was no evidence that the vanadium in the Syncrude coke played a role in the corrosion. 6 refs., 11 figs., 2 tabs.

26736 (CEA-CONF-9703) **Study of hard materials for coating PWR components.** Aubert, M.; Bougault, A.; Brenet, D.;

Guttmann, M.; Benhamou, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie. Nov 1988. 9p. (In French). (CONF-8811180--: Meeting of the Societe Francaise d'Energie Nucleaire (SFEN), Paris, FR, November 23, 1988). Order Number DE89763986/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Cobalt free alloys colmonoys, ceniums, nitronics and alloy Ni50Mo35Cr13 are compared to stellite 6 for vane parts in nuclear power plants. No material is as good as stellite, nitronic 60 is fairly good but hardness should be increased possibly by carbide dispersion.

26737 (CONF-8903109--1) **Weldability and microstructural characterization of Al-Li alloys.** Zacharia, T.; David, S.A.; Vitek, J.M.; Martukanitz, R.P. Oak Ridge National Lab., TN (USA). 1989. 10p. DOE Contract AC05-84OR21400. From 5. international aluminum-lithium conference; Williamsburg, VA, US; March 28, 1989. Order Number DE89010183/JAW. Available from NTIS, PC A02 - OSTI.

An investigation was carried out to determine the weldability, properties and microstructural characteristics of aluminum-lithium Alloys 2090 and 2091. Electron beam welds were made on 12.5-mm-thick plates to study the effect of welding conditions on the weldability and microstructure. The results indicate that these alloys are susceptible to fusion zone cracking. Following welding, a loss of hardness was observed in the fusion zone and the heat affected zone of Alloy 2090. After postweld aging the fusion zone hardness was partially restored and the heat-affected zone hardness was completely restored. Microhardness measurements did not reveal any such loss in hardness in the heat-affected zone of Alloy 2091. The result of the hot ductility tests indicate that these alloys are not susceptible to heat-affected zone cracking. 9 refs., 10 figs.

26738 (DOE/ER/01198--T35) **Channeling studies of the location of zinc in GaAs.** Christenson, K.K. Illinois Univ., Urbana, IL (USA). 1989. 134p. DOE Contract AC02-76ER01198. Available from Univ. of Illinois at Urbana, Urbana, IL.

The diffusion of zinc in GaAs is highly anomalous in that the diffusion coefficient (D) is proportional to the zinc concentration squared in marked contrast to Fick's law which predicts that D is concentration independent. D is also very sensitive to the ambient conditions during diffusion, particularly the arsenic overpressure and the presence of other doping species. Further, heavy zinc doping can increase the self diffusion rates for gallium and aluminum by 10^5 and is thus useful for selectively disordering GaAs/GaAlAs layer structures. The diffusion mechanisms involved are poorly understood, particularly the experimental finding that the column V sites (As, P and Sb) are not disordered. We believe that the anomalous nature can be explained by combining the theories of R.L. Longini (1962) on the effect of the hole density on the interstitial population and of K. Weiser (1962) on the effect of the charge state of an interstitial on the diffusion activation energy. To test our hypothesis, we have located the position of the zinc in the GaAs lattice with the ALCHEMI technique (Atom Location by CHanneling Enhanced MIcroanalysis) in a Transmission Electron Microscope (TEM). This required substantial enhancements to the x-ray microanalytic abilities of the TEM along with an improved understanding of the nature of the illumination in the immersion lens of a TEM, all of which are discussed. Our results indicate that, within the experimental error, all of the zinc occupies the gallium sites, which is consistent with our hypothesis. Further research involving TEM, synchrotron, diffusion and device studies are also suggested.

26739 (EGG-M--88512) **Detection of metal-transfer mode in GMAW.** Johnson, J.A.; Carlson, N.M.; Smartt, H.B. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 5p. DOE Contract AC07-76ID01570. (CONF-8905118--4: 2. international conference on trends on welding research, Gatlinburg, TN, US, May 15, 1989). Order Number DE89011133/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

One of the requirements of a sensing system for feedback control of gas metal arc welding (GMAW) is the capability to detect information about the metal-transfer mode. Because the operating boundary for the desired transfer mode, expressed as a function of mass input and heat input, may vary due to conditions beyond the control of the system, a means of determining the transfer mode during welding is necessary. A series of sensing experiments is performed during which the ultrasonic emissions, audio emissions, welding current fluctuations, and welding voltage fluctuations are recorded as a function of the transfer mode. In addition, high speed movies (5000 frame/s) of the droplet formation and detachment are taken synchronously with the sensing data. An LED mounted in the camera is used to work the film at the beginning and end of the data acquisition period. A second LED is pulsed at a 1 kHz rate and the pulses are recorded on film and with the sensor data. Thus events observed on the film can be correlated with the sensor data. Data acquired during globular transfer, spray transfer, and stiff spray or streaming transfer are observed to correlate with droplet detachment and arc shorting. The audio, current, and voltage data can be used to discriminate among these different transfer modes. However, the current and voltage data are also dependent on the characteristics of the welding power supply. 4 refs., 5 figs.

26740 (EPRI-GS--6286) **Sigma phase in 316 stainless piping: Main steam piping failure: Eddystone-1 Plant: Final report.** Ellis, F.V.; DeBeer, R.J.; Roberts, B.W.; Farber, V.; Kaufman, L.; Machlin, E.S.; Birnie, D. Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Chattanooga, TN (USA); Manlabs, Inc., Cambridge, MA (USA). Apr 1989. 70p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Even by todays standards, the Eddystone I power plant of the Philadelphia Electric Company, commissioned in 1959, represents ambitious steam conditions. It is a 325-MW, double-reheat unit designed for 5,000 psig, 1200/1050/1050°F (34.5 MPa, 649/566/566°C) turbine pressure and temperature. While the steam conditions have been reduced somewhat due to a number of initial operational problems, the unit still operates at 4,800 psig (33.1 MPa) and 1130°F (610°C) pressure and temperature to the superpressure turbine. In 1983, after 130,000 hours of operation, a steam leak developed in a TP316 austenitic stainless steel main steam line at Eddystone I. Extensive intergranular cracking was found in the axial direction from the outside diameter toward the inside diameter of the failed pipe. A 16Cr-8Ni-2Mo welding electrode was used to join the piping sections. Cracking was confined to four of the thirteen heats of the piping material while no weld metal cracking was observed. The presence of large sigma phase particles in the base metal grain boundaries was identified as a strong contributor to the failure. The objectives of the current research were to determine the heat to heat variability in sigma phase precipitation in base and weld material and to establish correlations with chemistry. The results indicate that an empirical nickel balance correlation adequately predicts the tendency to form sigma phase in base material. A nickel balance in excess of 2.5 is preferred while a nickel balance below 0.5 should be avoided. The amount of sigma phase in the 16Cr-8Ni-2Mo weld metal was small, and within the limited range of chemical compositions examined, no correlations were found. Therefore, 16-8-2 welds produced within the restricted chemical compositions of the current study should have good resistance to failure due to sigma phase formation. 6 refs., 12 figs., 11 tabs.

26741 (EPRI-GS--6339) **Fireside corrosion in low-NO_x combustion systems.** Daniel, P.L.; Chou, S.F.; Rodgers, L.W.; Ayres, P.S. Jr. Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Apr 1989. 121p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A program was undertaken to investigate ways to reduce NO_x emissions in coal-fired utility, boilers with cell burners. One task, the subject of this report, was to assess the potential for fireside corrosion under low NO_x conditions. This assessment is based on review and analysis of data from the literature, laboratory corrosion tests, and 5.6 million-Btu/hr pilot burner tests. Flame impingement and reducing gas are the two major concerns regarding potential fireside corrosion problems in low-NO_x combustion systems. Flame impingement can cause severe corrosion by unburned fuel constituents. In reducing gas, sulfur is released from coal as H_2S, which can sulfidize boiler tubes at furnace-wall temperatures. Fireside corrosion is affected by numerous operating variables including thermal cycling, gas composition, alternately oxidizing and reducing conditions, ash deposits, load, and furnace design and control. From the results of this research, several conclusions are drawn.

The low-NO_x combustion environment is generally more corrosive than conventional boiler combustion environments. However, by careful control of operating conditions and material selection, corrosion in the low-NO_x cell burner combustion system will be manageable. 13 refs., 36 figs., 9 tabs.

26742 (INIS-BR–1458, pp. 212) **Study of Mo-Ni alloys by X-ray spectroscopies.** Lawniczak-Jablonska, K. (Polska Akademia Nauk, Warsaw). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MOLYBDENUM/binary alloy systems; MOLYBDENUM/nickel; MOLYBDENUM/x-ray spectroscopy; NICKEL/binary alloy systems; NICKEL/molybdenum; NICKEL/x-ray spectroscopy; CRYSTAL STRUCTURE; ENERGY SPECTRA; MOLYBDENUM; NICKEL; VALENCE; X-RAY EMISSION ANALYSIS

26743 (INIS-BR–1458, pp. 244) **Study of α-radiation damage in a steel for fusion technology.** Caciuffo, R. (Ancona Univ. (Italy)); Rustichelli, F.; Coppola, R.; Osnarini, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HELIUM/bubbles; HELIUM/steels; STEELS/alpha beams; STEELS/net tokamak; STEELS/radiation effects; ANNEALING; CYCLOTRONS; HELIUM; BUBBLES; STEELS; IRRADIATION; MEV RANGE

26744 (INIS-BR–1458, pp. 265) **Diffusion enhancement in FeNi alloys during fast neutron irradiation.** Sciani, V. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Lucki, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALLOYS/fast neutrons; ALLOYS/irradiation; ALLOYS/point defects; IRON/alloys; IRON/diffusion; NICKEL/alloys; NICKEL/diffusion; ACTIVATION ENERGY; ALLOYS; IRRADIATION; CHROMIUM; DOPED MATERIALS; HIGH TEMPERATURE; IRON; DIFFUSION; MEV RANGE 01-10; MOLYBDENUM; NICKEL

26745 (IPEN-PUB–184) **Irradiation effects on the gas formation in metals and alloys.** Lucki, G.; Sciani, V. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Aug 1988. 53p. (In Portuguese). Order Number DE89610235/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Gaseous impurities are produced in structural materials and cladding of present fission reactors and of the future fusion reactors. The gases are generated from the following main sources: (a) Hydrogen production from the (n, p) nuclear reaction and Helium formation from (n, α) nuclear reaction in the structure of material, in all reactor types. (b) Tritium to Helium disintegration in the materials structure and diffusion of plasma fuel, Deuterium and Tritium, of the confinement system the exhaust system and the breeding blanket fusion reactors. In the present work a review is made emphasizing the effects of Helium, considered of major influence on the materials embrittlement. Experimental techniques are discussed, as well as, the results obtained in the Radiation damage Div. of the Instituto de Pesquisas Energeticas e Nucleares - CNEN/SP, are analysed.

26746 (LBL–26508) **Scanning tunneling microscopy of copper electrodeposited in the presence of benzotriazole.** Armstrong, M.J.; Muller, R.H. Lawrence Berkeley Lab., CA (USA). Dec 1988. 13p. DOE Contract AC03-76SF00098. (CONF-890518–1: 175. meeting of the Electrochemical Society, Los Angeles, CA, US, May 7, 1989). Order Number DE89007497/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the present work, the effects of benzotriazole (BTA) on the topography of Cu deposited on a Pt <111> single crystal surface under potential control was investigated with STM. The surfaces of the Cu deposits were continuously scanned with the tunneling probe during deposition. In the presence of BTA the initial monolayer of Cu was detected. 4 refs., 2 figs.

26747 (LBL–26805) **Surface structural analysis of small molecules on transition metal single crystal surfaces with low energy electron diffraction.** Blackman, G.S. Lawrence Berkeley Lab., CA (USA). Sep 1988. 149p. DOE Contract AC03-76SF00098. Order Number DE89010681/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

An attempt was made to go beyond the normal restrictions of surface crystallography. Low-temperature adsorption and coadsorbate induced ordering can be used to stabilize high coverage structures which would otherwise not form. Conventional LEED requires long-range order, digital LEED is sensitive enough to detect weak scattering from disordered adsorbates with no long-range order. Complete surface structures are presented for the first surface structure of NO, CO + benzene, NO + ethylidyne, and CO + ethylidyne all on the Rh(111) surface, and the first disordered molecular adsorbate: CO on Pt(111). Coadsorbate-induced ordering occurs when two adsorbates form a different ordered structure than either would form by itself. The lateral interactions between adsorbates force the molecules to populate new sites. Pure CO or NO overlayers have only top and bridge sites occupied, but if either molecule is paired with a coadsorbate (e.g., CO/benzene, CO/ethylidyne, or NO/ethylidyne) they move to hollow sites. Recent theoretical developments by Pendry et al. and new experimental techniques (digital LEED, this work) have made it possible to study disordered overlayers. The new digital LEED apparatus is sensitive enough to measure the weak diffuse scattering from disordered CO on Pt(111) to determine its structure. The first surface structure of a disordered molecular adsorbate is presented in this work.

26748 (N–89-16041) **High performance alloy electroforming. Final report.** Malone, G.A.; Winkelman, D.M. Bell Aerospace Textron, Buffalo, NY (USA). 1989. 209p. (NASA-CR–183562; NAS–1.26:183562; BAT–8874-927001). Available from NTIS, PC A10/MF A01.

Electroformed copper and nickel are used in structural applications for advanced propellant combustion chambers. An improved process has been developed by Bell Aerospace Textron, Inc. wherein electroformed nickel-manganese alloy has demonstrated superior mechanical and thermal stability when compared to previously reported deposits from known nickel plating processes. Solution chemistry and parametric operating procedures are now established and material property data is established for deposition of thick, large complex shapes such as the Space Shuttle Main Engine. The critical operating variables are those governing the ratio of codeposited nickel and manganese. The deposition uniformity which in turn affects the manganese concentration distribution is affected by solution resistance and geometric effects as well as solution agitation. The manganese concentration in the deposit must be between 2000 and 3000 ppm for optimum physical properties to be realized. The study also includes data regarding deposition procedures for achieving excellent bond strength at an interface with copper, nickel-manganese or INCONEL 718. Applications for this electroformed material include fabrication of complex or re-entry shapes which would be difficult or impossible to form from high strength alloys such as INCONEL 718.

26749 (NUREG/CR–5330) **High-temperature crack-arrest behavior in 152-mm-thick SEN wide plates of quenched and tempered A 533 grade B class 1 steel.** Naus, D.J.; Keeney-Walker, J.; Bass, B.R.; Bolt, S.E.; Fields, R.J.; deWit, R.; Low, S.R. III. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; National Inst. of Standards and Technology, Gaithersburg, MD (USA); Oak Ridge National Lab., TN (USA). Apr 1989. 150p. DOE Contract AC05-84OR21400. (ORNL/TM–11083). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

The Heavy-Section Steel Technology (HSST) Program at the Oak Ridge National Laboratory, under the sponsorship of the US Nuclear Regulatory Commission, is conducting analytical and experimental studies aimed at understanding the circumstances that would initiate the growth of an existing crack in a reactor pressure vessel and the conditions that would lead to arrest of a propagating crack.

HSST wide-plate crack-arrest tests are being performed at the National Institute of Standards and Technology (NIST), Gaithersburg, Maryland, in a 27-MN-capacity testing machine. This report contains results for two tests that used A 533 grade B class 1 material. Each test used a 1 x 1 x 0.15 m thick single-edge notched plate (a/w = 0.2) that was subjected to a linear thermal gradient along the plane of crack propagation. The thermal gradient was applied to the specimen by cooling the notched edge and heating the other edge. By varying the crack-tip temperature and transverse temperature profile, the initiation load and depth of crack propagation were changed from test to test. During each test, strain and temperature measurements were obtained as functions of position and time. Load, crack-opening displacement, and acoustic-emission data were also obtained as functions of time. 24 refs., 91 figs., 12 tabs.

26750 (PB–89-159784/XAB) **Vacuum induction melting of Ti-6Al-4V in a cold crucible. Report of investigations/1988.** Paige, J.I. Bureau of Mines, Albany, OR (USA). Albany Research Center. May 1988. 13p. (BUMINES-RI–9211). Available from NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-600280.

The effect of fluoride inclusions on the properties of titanium produced from the Bureau of Mines-developed induction slag-melting process is of concern to the titanium industry. The objective of the research was to determine the effect of removing the nonconductive molten calcium fluoride (CaF_2) slag used as an insulator between the titanium and the segmented copper crucible. The data were obtained from single-induction-melted ingots prepared with no CaF_2 insulating slag and an ingot prepared with the normal addition of 4% CaF_2 slag. The results showed that the mechanical properties of single-induction-slag-melted and annealed Ti-6Al-4V alloy exceed the minimum values specified in Aerospace Materials Specification for Titanium Alloy Bars and Forgings AMS4928H. High-cycle, tension-tension fatigue testing yielded similar results. The data from 44 of the 45 specimens were contained within the typical scatter band for fatigue data on wrought Ti-6Al-4V alloy. Although the removal of the insulating slag is a desirable change, the data from the specimens with the previously standard 4% slag addition showed no detrimental effect from the slag inclusions.

26751 (PB–89-858732/XAB) **Ablation and ablative materials: aerospace applications and materials studies. January 1977-March 1989 (Citations from the NTIS data base). Report for January 1977-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 172p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-862586.

This bibliography contains citations concerning ablation processes and ablative materials pertaining to aerodynamic surfaces and propulsion structures. Material ablation in combustion processes, heat-shield and reentry structures, and rocket nozzles is discussed. Composites, ceramics, and graphite compounds are among the specific materials considered. Computer simulations of ablation processes are also included. Citations pertaining specifically to ablation processes in plasma physics and fusion studies are excluded. (This updated bibliography contains 298 citations, 13 of which are new entries to the previous edition.)

26752 (PB–89-859268/XAB) **Coatings for metal cutting and forming tools. January 1970-March 1989 (Citations from the COMPENDEX data base). Report for January 1970-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 122p. Available from NTIS PC N01/MF N01.

Supersedes PB–86-877040.

This bibliography contains citations concerning the bond and wear characteristics of hard, antifriction, and thermal-insulating coatings on metal cutting and forming tools and dies. The metal carbides and oxides, ceramic coatings and their deposition techniques, CVD, ion nitriding, and sputtering are included. The effects of coatings on tool wear, and performance comparisons of various substrate/coating combinations are discussed. (This updated bibliography contains 258 citations, 94 of which are new entries to the previous edition.)

26753 (PNL-SA–16311) **Quantitative modeling of sensitization development in austenitic stainless steel.** Bruemmer, S.M. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 41p. DOE Contract AC06-76RL01830. (CONF-890437–11: Corrosion '89, New Orleans, LA, US, April 17, 1989). Order Number DE89011206/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Stainless steel is the most versatile, corrosion-resistant alloy for engineering structures. Applications encompass a wide range of temperatures from cryogenic to elevated and stainless steels are used in various industries including power production, chemical and petrochemical, food processing, dairy and waste handling/processing. In each case, resistance to general corrosion in aggressive environmental conditions justifies its selection. Unfortunately, like most metal systems which form passive films for corrosion resistance, stainless steels are susceptible to localized attack under certain environmental conditions. The primary forms of this localized attack are pitting, intergranular (IG) corrosion and stress corrosion cracking (SCC). Sensitization is often directly responsible for the latter two and can also have an effect on pit initiation. The present work reviews the basic approach to model sensitization (chromium depletion) development in unstabilized, austenitic stainless steels. A theoretically-based, empirically-modified model is presented to quantitatively predict material degree of sensitization (DOS). Individual model components are discussed and compared to experimental results. Finally, overall model predictions are assessed relative to a large sensitization data base. More detailed information concerning this data base and model evolution has been reported elsewhere. 42 refs., 18 figs.

26754 (PNL-SA–16474) **Modeling grain boundary microchemistry related to IASCC [irradiation-assisted stress corrosion cracking].** Simonen, E.P.; Jones, R.H. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 18p. DOE Contract AC06-76RL01830. (CONF-890437–12: Corrosion '89, New Orleans, LA, US, April 17, 1989). Order Number DE89011214/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Radiation effects on grain boundary and near grain boundary microchemistries are modeled and compared to measured radiation effects. Nonequilibrium diffusion mechanisms are shown to be consistent with measured phosphorus impurity segregation and measured chromium depletion resulting from irradiation. Radiation enhanced equilibrium segregation (impurity enrichment) and radiation enhanced chromium depletion (sensitization) kinetics are predicted to be sufficient to promote equilibrium effects but measurements do not confirm the radiation enhanced mechanisms. Likely causes for the discrepancy are solute trapping and precipitation effects in the matrix promoted by irradiation. Ion and neutron irradiation of austenitic steels are evaluated relative to causes for irradiation-assisted stress corrosion cracking (IASCC). 35 refs., 11 figs.

26755 (SAND–88-2447C) **Parameter estimation for a viscoelastic constitutive model.** Rogers, J.D.; Skaar, S.B. Sandia National Labs., Albuquerque, NM (USA). 1988. 7p. DOE Contract AC04-76DP00789. (CONF-8905107–2: SEM spring meeting, Cambridge, MA, US, May 28, 1989). Order Number DE89008714/JAW. Available from NTIS, PC A02 - OSTI.

A four viscoelastic material model has been incorporated into a well-defined vibration test. The model includes as a parameter the order of the time derivations of stress and strain. Values of the parameters were obtained for aluminum and plexiglas beam specimens. 12 refs., 11 figs., 2 tabs.

26756 (SAND–89-0401C) **Thermomechanical fatigue of solder joints: A new comprehensive test method.** Frear, D.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 36p. DOE Contract AC04-76DP00789. (CONF-8905102–1: 39. electronic components conference, Houston, TX, US, May 22, 1989). Order Number DE89008045/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents a new comprehensive method to test solder joint in thermomechanical fatigue. The method involves simultaneous imposition of temperature cycles and strain on discrete solder joints in a shear orientation. The stress, microstructure, and number of cycles to failure were monitored. Cycles to failure were determined by a continuous electrical detection method. 60Sn-40Pb and 40Sn-40In-20Pb solder joints were tested using this new method at 20% shear strain. The 60Sn-40Pb alloy has a shorter fatigue lifetime

than did 40Sn-40In-20Pb. This is attributed to heterogeneous coarsening that concentrates strain into a small area of the 60Sn-40Pb microstructure. In contrast, the 40Sn-40In-20Pb microstructure becomes refined. The heterogeneous coarsening also results in cyclic softening in 60Sn-40Pb, which was not observed in 40Sn-40In-20Pb. Failures initiated within the coarsened band in 60Sn-40Pb at Sn-Sn grain boundaries or phase boundaries. In contrast, failures initiated at the surface of 40Sn-40In-20Pb joints and propagated through both phases of the microstructure. 41 refs., 16 figs.

26757 (UCRL–100776) **The influence of cooling rate on the ferrite content of stainless steel alloys.** Elmer, J.W.; Allen, S.M.; Eagar, T.W. Lawrence Livermore National Lab., CA (USA). 24 Mar 1989. 19p. DOE Contract W-7405-ENG-48. (CONF-8905118–1: 2. international conference on trends on welding research, Gatlinburg, TN, US, May 15, 1989). Order Number DE89009966/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electron-beam surface melting was used to rapidly solidify a series of high-purity 59% Fe-Ni-Cr alloys at cooling rates between 7 °C/s and 7.5 x 10^6 °C/s. The primary solidification mode was identified in each of the resolidified melts using optical metallography; the residual ferrite content was measured using a vibrating sample magnetometer. The cooling rate was shown to dramatically alter the residual ferrite content of these alloys through its influence on the amount of solute redistribution that occurs during solidification and through its subsequent influence on the extent of the solid-state transformation of ferrite. The results show that the solidification mode, cooling rate, and specific alloy composition are equally important, interrelated factors in the prediction of the residual ferrite. The residual ferrite content of primary-austenite solidified alloys decreases with increasing cooling rate whereas the residual ferrite content of primary-ferrite solidified alloys increases with increasing cooling rate. Exceptions to this general behavior occur when: ferrite transforms to austenite by a massive transformation in fully-ferritic-solidified alloys and an alloy changes its mode of solidification from primary-ferrite at low cooling rates to primary-austenite at high cooling rates. 12 refs., 7 figs., 4 tabs.

26758 (WU–15SQ.23440-3-9104) **Fabrication and evaluation of welded joint structures in marine environments. Phase 1: final report. Fatigue crack development, thickness and corrosion effects in welded plate-to-plate and pipe-plate joints.** Pates, M.J.; Burns, D.J.; Mohaupt, U.H.; Kalbfleisch, J.G.; Lambert, R.S.; Yee, R. Waterloo Univ., Ontario (Canada). 1988. 215p. (MICROLOG–88-05983). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Potential drop techniques have been used to detect the early stages of crack development and to size fatigue cracks in plate-to-plate welded T-joints. These data have been used to assess the influence that stress amplitude, plate thickness and environment have on fatigue crack initiation and propagation. Statistical techniques have been used to interpret the data. Fatigue tests in air indicate that increasing plate thickness decreases initiation and propagation life. Tests in artificial seawater, with or without cathodic protection, indicate that fatigue life is reduced by a factor of 2.5 to 3 with free corrosion and that the beneficial effects, if any, of cathodic protection are too small and variable to account for in life assessments. A pipe-to-plate specimen has been developed to model the fatigue behavior of welded T-tubular joints. Potential drop techniques have been used to monitor crack development in pipe-plate specimens. This data is compared with similar data for a T-tubular and T-plate joints. Crack growth rates have been used to derive empirical stress intensity factors for comparison with like data published for various tubular configurations. These comparisons indicate that the pipe-plate specimen is a reasonable model of a tubular joint. Tests on pipe-plate specimens in artificial seawater with free corrosion, optimum cathodic protection or cathodic overprotection confirm the trends observed in the T-plate tests and highlight the influence that these environments have on crack shape development and crack growth rates. 25 refs., 108 figs., 23 tabs.

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Refer also to citation(s) 26316, 26316, 26739, 26751, 26752, 26777, 26801, 26831, 27018, 27724

26759 (AD-A–202598/9/XAB) **Effects of different fabrication techniques on the yttrium-barium-copper oxide high-temperature superconductor. Master's thesis.** Rhea, P.A. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 110p. (AFIT/GE/ENG–88D-42). Available from NTIS, PC A06/MF A01.

This study examines how several different parameters were changed in the yttrium-barium-copper oxide superconductor when the fabrication techniques were altered by using different barium precursors, including barium peroxide and barium carbonate; sintering at different temperatures, including 850, 900, and 950 C; and annealing in an above ambient oxygen environment. Twelve different pellets were fabricated, and measurements were taken on them which included density, x-ray diffraction, critical temperature, critical current density, and magnetic susceptibility. Results showed that the barium perioxide derived samples had higher densities, better critical current densities and lower resistivities in the normal state.

26760 (AD-A–202887/6/XAB) **Optical-reflectivity studies of polycrystalline $La_4BaCu_5O_{13}$ and $La_2SrCu_2O_6$.** Kaplan, S.G.; Noh, T.W.; Sulewski, P.E.; Xia, H.; Sievers, A.J. Cornell Univ., Ithaca, NY (USA). Lab. of Atomic and Solid State Physics. 1 Sep 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review B, Vol. 38, No. 7, 5006-5009(1 Sep 1988).

Optical-reflectivity measurements were made on polycrystalline samples of $La_4BaCu_5O_{13}$ and $La_2SrCu_2O_6$, two nonsuperconducting oxides. The effective optical conductivities of these materials show a peak between 0.5 and 1 eV, similar in magnitude to that previously observed in $YBa_2Cu_3O_7$-x and La_2-x$SrxCuO_4$. Observations indicate that this spectral feature is an extrinsic effect related to the composite nature of the samples and is not relevant to superconductivity in this class of materials.

26761 (AD-A–203076/5/XAB) **Coupled even-parity superconducting states: square lattice.** Langner, A.; Sahu, D.; George, T.F. State Univ. of New York, Buffalo, NY (USA). 1988. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Superconductivity and Its Applications, 57-62(1988).

The Ginzburg-Landau free energy density for the coupling s-wave and d-wave superconducting states in square planar symmetry is considered. Four single-order-parameter states (Ginzburg Landau) and a mixed state are enumerated along with analytical relations for their thermodynamic critical fields, Hc, and critical temperatures. The differential Ginzburg-Landau equations are derived and applied to the calculation of the upper and lower critical fields, Hc2 and Hc1. The relevance of the analysis of superconductivity in the Cu-O planes of the high-Tc materials is discussed.

26762 (CEA-CONF–9753) **Moessbauer investigation of iron doped $YBa_2Cu_3O_{7-x}$.** Dalmas de Reotier, P.; Gil, E.; Vulliet, P.; Yaouanc, A.; Senateur, J.P.; Weiss, F.; Chaudouet, P. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale. 1988. 7p. (CONF-880705–: International conference on magnetism (ICM '88), Paris, FR, July 25, 1988). Order Number DE89763996/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

We have recorded ^{57}Fe Moessbauer spectra of YBa_2 $(Cu_{1-y}$ $Fe_y)_3O_{7-x}$ powder sample and uniaxially oriented powder for $0.01 \leq y \leq 0.1$ and $x \simeq O$ or $x \simeq 1$. In the superconducting $x \simeq O$ compounds we see three subspectra for $y > 0.01$ and four subspectra for y=0.01. These subspectra correspond to different oxygen configurations around the iron atoms. From the oriented YBa_2 $(Cu_{.94}$ $Fe_{.06})_3O_7$ and YBa_2 $(Cu_{.9}$ $Fe_{.1})_3O_6$ compounds we deduce that more than 90% iron substitutes Cu(1) site. The iron magnetic moments order antiferromagnetically at $\simeq$18 K and $\simeq$1.5 K for the x=0, y=0.06 and x=0, y=0.01 compounds respectively.

26763 (DOE/ER/45321–2) **[Strong fibers]: [Progress report].** Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering. [1989]. 3p. DOE Contract FG02-87ER45321. Order

Number DE89010596/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimental effort was developed with a major aim of expanding the range of deposition processes and detailed microfabrication procedures that could be incorporated in our generic approach to new materials development and fiber fabrication. Equipment for mechanical characterization of fine fibers was also designed and constructed. Major activities were: (1) To incorporate chemical vapor deposition processes into the patterning, deposition, and lift-off sequence for fabricating strong fibers. The material of choice was silicon nitride. (2) A project to evaluate and explain the different and high strengths of aluminum fibers produced by different deposition processes. (3) Alloy oxide films and fibers are being produced by dual source electron beam evaporation. Variable but controlled amounts of zirconium or titanium are added to aluminum oxide. (4) Silicon carbide films with variable silicon to carbon ratios have been produced by chemical vapor deposition. (5) A micro-tensile testing apparatus was designed and constructed for measuring the tensile strengths of the fibers produced in the program.

26764 (EGG-M–10087) **Ultrasonic characterization of porosity in advanced SiC ceramic composites.** Walter, J.B.; Lott, L.A.; Gammell, P.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1987. 11p. DOE Contract AC07-76ID01570. (CONF-870856–5: Conference on nondestructive testing of high performance ceramics, Boston, MA, US, August 25, 1987). Order Number DE89011159/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The particular material considered here was SiC fiber reinforced SiC matrix formed by chemical vapor infiltration (CVI). The initial focus was on porosity, which has been linked to the material strength. Ultrasonic attenuation and velocity were investigated since they were expected to be affected by the porosity in the material. The objectives of the study were to determine the capability of conventional methods to measure the ultrasonic properties of the materials, and develop improved methods where necessary; to determine the correlations between ultrasonic properties and material properties of interest; and to demonstrate the ability of the ultrasonic technique to nondestructively characterize ceramic composite components. 8 refs., 4 figs.

26765 (ENEA-RT-TIB–88-29, pp. 95-103) **Applications of laser for ceramic alloying on metal surfaces.** Cruciani, D. (RTM, Vico Canavese (Italy)); Molino, G.; Musci, M.; Borsella, E.; Fantoni, R. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Ceramic and metallic-ceramic materials were alloyed and cladded on a C40 steel by means of a Co_2 laser heat source. The main objective of the research were to obtain a surface modification of the C40 steel in order to increase its wear resistence and to develop a repeatable coating process of potential industrial application.

26766 (INFN-LNF–88-71(P)) **Ozone annealing of YBCO superconductors. Toward the maximum of diamagnetic Tc and minimum of δ Tc.** Cellani, F.; Liberatori, L.; Saggese, A.; Messi, R.; Pace, S.; Sparvieri, N. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1988. 8p. (CONF-8810255–: International symposium on the electronic structure of High Tc superconductors, Rome, IT, October 5, 1988). Order Number DE89610237/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A.C. low frequency susceptibility measurements, using the "inductance variation" method, have been performed on sintered YBCO pellets fabricated using a new process. This process is based on a modified citrate pyrolysis method and on the use of ozone in all the thermal treatments. The diamagnetic behaviour of this material have been studied as a function of the temperature changing both the amplitude of the a.c. magnetic field (0.2,2,8 Gauss) and the test frequency (120,1K, 10K Hertz). At 0.2 Gauss the width (10%-90%) of the diamagnetic transition of the azone samples is as low as 2K with a diamagnetic Tc of 98K. This width value obviously enlarges with the increase of the applied field: at 2 Gauss, with almost the same Tc, δTc increases up to 6K. The behaviour at 8 Gauss clearly shows the contributions to the diamagnetic signal due both to the intergrain Jj coupling and to the isolated grains. The ozone annealed samples are compared with both oxygen annealed samples and samples made following the conventional calcination-refiring procedure: the last two show larger transition widths and a lower stability against water.

26767 (INIS-BR–1458, pp. 260) **Measurements of equivalent attenuation coefficients of dental enamel and bone.** Duran, J.E.R. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ENAMELS/irradiation; ENAMELS/teeth; ENAMELS/x radiation; SKELETON/irradiation; SKELETON/x radiation; ATTENUATION; ENAMELS; IRRADIATION; TEETH; KEV RANGE 10-100; SKELETON; X-RAY SOURCES

26768 (INIS-BR–1458, pp. 261) **Total mass energy absorption coefficients and f-factor for human tooth enamel.** Duran, J.E.R. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ENAMELS/absorption; ENAMELS/energy dependence; ENAMELS/radiation effects; TEETH/absorption; TEETH/energy dependence; TEETH/radiation effects; CHEMICAL COMPOSITION; ENAMELS; ABSORPTION; IONIZING RADIATIONS; IRRADIATION; KEV RANGE 10-100; TEETH

26769 (LA-UR–89-1273) **The formation and analysis of thin film high temperature superconductors.** Nastasi, M.; Muenchausen, R.E.; Arendt, P.N. Los Alamos National Lab., NM (USA). 1989. 26p. DOE Contract W-7405-ENG-36. (CONF-8904182–2: SCANNING '89/EM West, Long Beach, CA, US, April 5, 1989). Order Number DE89011177/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thin films of high temperature superconductors have been fabricated using a variety of physical vapor deposition techniques. Recent results of HTS thin films produced by coevaporation, sputtering and laser deposition will be briefly reviewed. In addition some examples of the utility of high energy ion backscattering for the analysis of film stoichiometry will be given. 34 refs., 6 figs.

26770 A container for heat treating materials in microwave ovens. Holcombe, C.E.; Dykes, N.L.; Kimrey, H.D. Jr.; Mills, J.E. To Dept. of Energy. USA Patent Application 7-148,530. 26 Jan 1988. 14p. DOE Contract AC05-84OS21400. Order Number DE89010812/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The efficiency of a microwave oven of a conventional two-source configuration and energy level is increased by providing the oven with a container for housing a refractory material to be treated. The container is formed to top and bottom walls transparent to microwaves while the sidewalls, in a circular configuration, are formed of a nonmetallic material opaque to microwave radiation for reflecting the radiation penetrating the top and bottom walls radially inwardly into the center of the container wherein a casket of heat-insulating material is provided for housing the material to be heat treated. The reflection of the microwave radiation from the sidewalls increases the concentration of the microwaves upon the material being heat treated while the concentration of the microwaves upon the material being heat treated while the casket retains the heat to permit the heating of the material to a substantially higher temperature than achievable in the oven without the container.

26771 Process for preparing titanium nitride powder. Bamberger, C.E. To Dept. of Energy. USA Patent Application 7-207,806. 17 Jun 1988. 10p. DOE Contract AC05-84OR21400. Order Number

DE89010801/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A process for making titanium nitride powder by reaction of titanium phosphates with sodium cyanide. The process of this invention may comprise mixing one or more phosphates of Ti with a cyanide salt in the absence of oxygen and heating to a temperature sufficient to cause reaction to occur. In the preferred embodiment the ratio of cyanide salt to Ti should be at least 2 which results in the major Ti-containing product being TiN rather than sodium titanium phosphate byproducts. The process is an improvement over prior processes since the byproducts are water soluble salts of sodium which can easily be removed from the preferred TiN product by washing. 2 tabs.

26772 (PB–89-160469/XAB) **Study of the toughness of plasma-deposited yttriated zirconia coats using indentation measurement.** Mouginot, R.; Foujanet, M.C. Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France). Centre Mecanique Chimie Materiaux. 3 Apr 1987. 48p. (In French). (ETCA–87-R-040). Available from NTIS, PC EE04/MF E04.

The strength of yttriated zirconia-based zirconia is measured by observing Vickers indentation fractures. In the samples studied, the hardest materials were also the ones with the least resistance. Hardness varied according to the load applied, because of the porosity of the plasma-deposited layer. The hardness of solid zirconia is around 10 GPa, compared to about 5 GPa for plasma-deposited zirconia.

26773 (PB–89-161350/XAB) **Preliminary study of the ceramic-metal interface in the case of thermal barriers.** Tremouilles, G. Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France). Centre Mecanique Chimie Materiaux. 7 Oct 1987. 53p. (In French). (ETCA–87-R-101). Available from NTIS, PC EE04/MF E04.

This study examines the ceramic-metal interface between an yttriated zirconia layer and a sublayer of NiCrAlY deposited on an Inconel base. The presence of alumina is demonstrated at the interface, and the different phases in which the zirconia exists are studied by transmission electron microscopy. The Inconel substrate is damaged as soon as the NiCrAlY sublayer is hit by a plasma torch.

26774 (PNL–6805) **Laboratory-scale testing of non-consumable anode materials: Inert Electrodes Program.** Marschman, S.C. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 37p. DOE Contract AC06-76RL01830. Order Number DE89010283/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of inert anode materials for use in the electrolytic production of aluminum is one of the major goals of the Inert Electrodes Program sponsored by the US Department of Energy, Office of Industrial Programs, at Pacific Northwest Laboratory. The objectives of the Materials Development and Testing Task include the selection, fabrication, and evaluation of candidate non-consumable anode materials. Research performed in FY 1987 focused primarily on the development and evaluation of cermets that are based on the two-phase oxide system NiO–$NiFe_2O_4$ and contain a third, electrically conductive metal phase composed primarily of copper and nickel. The efforts of this task were focused on three areas: materials fabrication, small-scale materials testing, and laboratory-scale testing. This report summarizes the development and testing results of the laboratory-scale testing effort during FY 1987. The laboratory-scale electrolysis testing effort was instrumental in partially determining electrolysis cell operating parameters. Although not optimized, NiO–$NiFe_2O_4$–Cu-based cermets were successfully operated for 20 h in cryolite-based electrolytes ranging in bath ratios from 1.1 to 1.35, in electrolytes that contained 1.5 wt % LiF, and at conditions slightly less than Al_2O_3 saturation. The operating conditions that lead to anode degradation have been partly identified, and rudimentary control methods have been developed to ensure proper operation of small electrolysis cells using nonconsumable anodes. 11 figs., 1 tab.

26775 (PNL-SA–16187) **Optical properties of metal-oxide thin films: influence of microstructure.** Ferris, K.F.; Thompson, M.R.; Exarhos, G.J.; Frydrych, W.S.; Duke, C.B.; Hess, N.J. Pacific Northwest Lab., Richland, WA (USA). Oct 1988. 11p. DOE Contract AC06-76RL01830. (CONF-8810296–5: Boulder damage symposium, Boulder, CO, US, October 26, 1988). Order Number DE89011219/JAW. Available from NTIS, PC A03 - OSTI.

The optical response of a dielectric film is perturbed from that of the analogous bulk material by the inherent film microstructure. A mean field approach has been developed for modeling the real part of the dielectric constant in terms of film microstructure. On this basis, eventual determination of film microstructure parameters such as void density and grain size could be determined from the measured optical response of the film. A semiempirical 'fragment' method has also been used to model the imaginary part of the refractive index for titania. Differences in the electronic transition energies for the anatase and rutile phases of titania are ascribed to dielectric field variation rather than changes in the localized chemical bonding around the titanium site. 20 refs., 2 figs., 4 tabs.

26776 (SAND–89-0951C) **Ferroelectric potassium niobate thin films.** Tuttle, B.A.; Bunker, B.C.; Lamppa, D.L.; Tissot, R.G.; Yio, J.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 14p. DOE Contract AC04-76DP00789. (CONF-890421–5: 91. annual meeting of the American Ceramic Society, Indianapolis, IN, US, April 23, 1989). Order Number DE89010862/JAW. Available from NTIS, PC A03 - OSTI.

We report on the first ferroelectric measurements of chemically prepared $KNbO_3$ thin films. Polycrystalline $KNbO_3$ thin films were fabricated by dip coating substrates with methanolic solutions of potassium hydroxide and niobium ethoxide. Perovskite $KNbO_3$ was obtained for both bulk gels and films by using 800°C firing treatments. For films, the intermediate temperature processing schedule was critical for the complete conversion of low temperature phases to perovskite $KNbO_3$. Raman spectroscopy and x-ray diffraction analysis confirmed that properly processed films possessed the orthorhombic distortion of the perovskite structure at room temperature. In response to a 1 kHz, sinusoidal field of 300 kV/cm amplitude, we measured the following ferroelectric properties: (1) a remanent polarization of 4.5 $\mu C/cm^2$, (2) a spontaneous polarization of 8.3 $\mu C/cm^2$, and (3) a coercive field of 55 kV/cm.

3606 Other Materials

Refer also to citation(s) 26320, 26333, 26337, 26337, 26338, 26340, 26342, 26360, 26360, 26660, 26739, 26751, 26755, 26842, 26911, 27004, 27019, 27021, 27021, 27654, 27656, 27658, 27659, 27791

26777 (AD-A–202518/7/XAB) **Behavior of ceramic-matrix, fiber composites under combined impact and tensile stresses. Final report, September 1986-September 1987.** Phillips, C.; Park, N.; Lee, R.J.; Preston, R.F.; Dawson, D.M. UKAEA Research Group, Harwell. Atomic Energy Research Establishment. May 1988. 94p. (AERE-R–12941). Available from NTIS, PC A05/MF A01.

The impact behavior of fiber composites with glass and glass-ceramic matrices was studied. The materials, which were selected as model systems for high-temperature ceramic composites, consisted of graphite fibers in borosilicate glass and lithium aluminosilicate (LAS) glass-ceramic matrices. Impact testing was carried out on crossplied material of lay-up (0, 90) 2S. Several different types of impact experiments were carried out. In one, specimens were impacted at room temperature by an instrumental falling weight impactor while subjected to a superimposed tensile stress. The amount of damage caused in this test depends on the level of stress and impact energy. The concept of an impact map was developed: taking total fracture as the failure criterion, an impact map can be constructed in which impact energy is plotted against applied stress.

26778 (AD-A–202596/3/XAB) **Time-resolved photoluminescence of ytterbium in indium phosphide. Master's thesis.** Bumgarner, T.F. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 117p. (AFIT/GEP/ENP–88D-1). Available from NTIS, PC A06/MF A01.

Time-resolved photoluminescence of ytterbium (Yb) implanted in indium phosphide (Inp) was the primary emphasis of this research. The decay lifetimes of the 1002-nm Yb emission were investigated

as a function of temperature. Initial attempts were made to investigate as a function of temperature. Initial attempts were made to investigate aluminum gallium arsenide (AlGaAs) implanted with ytterbium.

26779 (AD-A–202705/0/XAB) **Investigation of failure modes in fiber-reinforced ceramic-matrix composites. Master's thesis.** Moschler, J.W. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 132p. (AFIT/GAE/AA–88D-28). Available from NTIS, PC A07/MF A01.

This experimental study was conducted to investigate the damage progression in fiber-reinforced ceramic-matrix composites under tensile loading. As part of this study, the effect of the residual stresses at the fiber-matrix interface on damage progression was evaluated. Composite samples were fabricated from silicon carbide fibers and borosilicate glass matrices. Each glass had a different coefficient of thermal expansion than the fiber and through the variation of this mismatch, the residual stresses at the fiber-matrix interface were varied resulting in different bonding conditions at the fiber-matrix interface. The mechanical properties of the composites were measured using a servo-hydraulic mechanical testing machine. During these tests, transverse strain reversal was observed that is believed to be caused by axial matrix cracks and fiber-matrix debonding. Tensile tests were conducted on the composites using a constant-load straining device in which damage progression was observed using an optical microscope.

26780 (AD-A–203072/4/XAB) **Ion-bomdardment-enhanced grain growth in germanium, silicon, and gold thin films.** Atwater, H.A.; Thompson, C.V.; Smith, H.I. Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics. 1 Sep 1988. 18p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 64, No. 5, 2337-2353(1 Sep 1988).

Grain growth was studied in polycrystalline thin films of germanium, silicon, and gold during ion bombardment. The phenomenon was characterized by varying the ion dose, ion energy, ion flux, ion species, substrate temperature, and thin-film deposition conditions. Films bombarded with Si(+), Ar(+), Ge(+), Kr(+), and Xe(+) exhibited enhanced grain growth that was as weakly temperature dependent and proportional to the energy deposited in elastic collisions at or very near grain boundaries. The effect of these parameters on grain size and microstructure was analyzed both qualitatively and quantitatively using transmission electron microscopy. A transition state model describing the motion of grain boundaries during ion bombardment was applied to the present experimental data. The results suggest that bombardment-enhanced grain growth may be due to thermal migration of bombardment-generated defects across the boundary. The calculated defect yield per incident ion was found to be directly related to enhanced grain growth, and was used to estimate the number of atomic jumps at the grain boundary per defect generated. Grain growth rates during bombardment and thermal annealing were related to their respective point defect populations.

26781 (AD-A–203173/0/XAB) **Distribution of boron atoms in ion-implanted-compound semiconductors. Technical report.** Bowman, R.C.; Knudsen, J.F.; Downing, R.G.; Kremer, R.E. Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab. 22 Nov 1988. 11p. (TR–0088(3945-07)-5). Available from NTIS, PC A03/MF A01.

The nondestructive neutron depth profiling (NDP) technique was used to measure the boron (10B) distributions in GaAs, CdTe, Hg0.7Cd0.3Te, and Hg0.85Mn0.15Te after multiple energy ion implants. The NDP results are found to be in good agreement with the theoretical ion ranges obtained from Monte Carlo computer simulations. Only minor changes in the boron profiles were seen for the chosen annealing conditions.

26782 (AD-A–203460/1/XAB) **Extended abstracts of the US workshop on the physics and chemistry of mercury cadmium telluride held in Orlando, Florida on October 11-13, 1988. Final report.** Schetzina, J.; Schmit, J. Palisades Inst. for Research Services, Inc., New York, NY (USA). Dec 1988. 192p. Available from NTIS, PC A09/MF A01.

This workshop was held as scheduled. Sessions included 1. Growth and Properties I: HgCdTe and related properties, 2. Novel Heterostructures and measurements, 3. Superlattices and electronic Properties, 4. Growth and properties II: mostly substrates, 5, Surfaces and interfaces, and 6. Defects.

26783 (DOE/ER/13478–3) **[Diffusion, fluid flow, and sound propagation in disordered media].** Keyes, T.F. Boston Univ., MA (USA). [1989]. 8p. DOE Contract FG02-86ER13478. Order Number DE89010937/JAW. Available from NTIS, PC A02 - OSTI.

The current grant was written so as to encompass a wide range of problems concerning transport in porous/disordered media; the methods to be applied were kinetic theory and renormalization methods. Using these techniques we obtained new results on several dynamical/transport problems where the role of disorder is crucial. This paper discusses those results.

26784 (DOE/ER/13789–2) **Studies of photochemically and electrochemically driven electron transport in zeolites: Progress report, April 1988–April 1989.** Mallouk, T.E. Texas Univ., Austin, TX (USA). Dept. of Chemistry. Apr 1989. 4p. DOE Contract FG05-87ER13789. Order Number DE89011494/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Electron transfer reactions in zeolites and related solid-state materials are being studied. Some particular areas of study are: Electron transfer reactions of linked sensitizer-acceptor molecules. We have studied via laser flash photolysis/transient absorbance the photochemistry of linked $Ru(bpy)_3$–diquat molecules exchanged onto the outer surface of zeolite L powder. Electron-donor quenching of excited-state RuL_3 complexes. We have studied electron transfer reactions between cyanometallate anions $M(CN)_8^{4-}$ (M = Mo,W), $M(CN)_6^{4-}$ (M = Fe,Os) and excited state ruthenium complexes; and quantum-size TiO_2 in zeolite L. We are attempting to prepare systems in which the conduction band of an oxide semiconductor is used to convey electrons from a sensitizer to a catalyst within a zeolite L particle. This report describes progress in the areas of: electron transfer reactions of donor/acceptor molecules at the zeolite/solution interface; and quantum size TiO_2 supported by zeolites L, Y, and A.

26785 (INIS-BR–1458, pp. 77) **Radiation damage and its annealing in soda glass detector.** Singh, G. (Gujarat Univ., Ahmedabad (India). Dept. of Physics); Virk, H.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GLASS/annealing; GLASS/physical radiation effects; GLASS/radiation detectors; ACTIVATION ENERGY; GLASS; ANNEALING; LANTHANUM 139; LEAD 208; TIME DEPENDENCE

26786 (INIS-BR–1458, pp. 128) **Measurement of changes in viscosity in polymers with gamma ray dose using differential viscometer.** Santra, L. (Bose Research Inst., Calcutta (India)); Bhaumik, D.; Roy, S.C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POLYMERS/alpha particles; POLYMERS/gamma radiation; POLYMERS/physical radiation effects; IRRADIATION; POLYMERS; VISCOSIMETERS; VISCOSITY

26787 (INIS-BR–1458, pp. 129) **Measurements of low gamma doses through induced changes in the mean molecular weight of polyvinyl alcohol.** Alsharbaty, H. (Baghdad Univ. (Iraq). Coll. of Science); Alabbas, L.A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PVA/gamma radiation; PVA/molecular weight; PVA/physical radiation effects; COBALT 60; PVA

26788 (INIS-BR–1458, pp. 130) **Mechanism of charge formation in the irradiated polyethylene.** Gromov, V.V. (AN SSSR,

Leningrad. Inst. Khimii Fiziki); Rozno, A.G.; Procopiev, O.V. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POLYETHYLENES/charge distribution; POLYETHYLENES/cross-linking; POLYETHYLENES/irradiation; CORRELATIONS; MOLECULAR STRUCTURE; POLYETHYLENES; CROSS-LINKING; IRRADIATION; SOUND WAVES

26789 (INIS-BR–1458, pp. 131) **Mechanism of electric charge formation in irradiated polyethylene.** Gromov, V. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii); Prokopyev, O. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POLYETHYLENES/electrons; POLYETHYLENES/gamma radiation; POLYETHYLENES/radiation effects; ELECTRIC CHARGES; IRRADIATION; POLYETHYLENES; ELECTRONS; SPATIAL DISTRIBUTION

26790 (INIS-BR–1458, pp. 132) **On the mechanism of varied irradiation frequency characteristics of natural and grown quartz crystals.** Bahadur, H. (National Physical Lab., New Delhi (India)); Parshad, R.; Mathur, B.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/quartz; QUARTZ/crystal defects; QUARTZ/frequency dependence; QUARTZ/irradiation; ALUMINIUM; ANNEALING; CRYSTAL GROWTH; QUARTZ; NEUTRONS; IRRADIATION; THERMOLUMINESCENCE

26791 (INIS-BR–1458, pp. 134) **Irradiation effects in Brazilian beryl.** Isotani, S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Albuquerque, A.R.P.L.; Dias, O.L.; Furtado, W. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BERYL/absorption spectroscopy; BERYL/gamma radiation; BERYL/physical radiation effects; ACTIVATION ENERGY; BERYL; COBALT 60; IRRADIATION

26792 (INIS-BR–1458, pp. 135) **Annealing kinetics of heavy ion radiation damage in crystalline minerals.** Sandhu, A.S. (Guru Nanak Dev Univ., Amritsar (India)); Ramola, C.; Singh, S.; Virk, H.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HEAVY IONS/fission fragment detection; HEAVY IONS/minerals; MINERALS/annealing; MINERALS/fission fragment detection; MINERALS/physical radiation effects; ABSORPTION SPECTROSCOPY; ACTIVATION ENERGY; MINERALS; ANNEALING; TEMPERATURE DEPENDENCE

26793 (INIS-BR–1458, pp. 136) **Radiation-induced room-temperature acoustic loss peaks in cultured quartz oscillator crystals.** Bahadur, H. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics); Hwang, H.B.; Martin, J.J. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

OSCILLATORS/physical radiation effects; OSCILLATORS/quartz; QUARTZ/oscillators; QUARTZ/physical radiation effects; ACTIVATION ENERGY; ALUMINIUM; IRRADIATION; LITHIUM; MEDIUM TEMPERATURE; OSCILLATORS; QUARTZ; PEAKS

26794 (INIS-BR–1458, pp. 137) **Oxidation states of CrIn solutions of thermal neutron irradiated chromates and dichromates.** Bhattacharyya, C. (Indian Inst. of Tech., Bombay. Dept. of Chemistry); Mukherji, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CHROMATES/irradiation; CHROMATES/thermal neutrons; CHROMIUM/indium; CHROMIUM/oxidation; CHROMIUM/solutions; DICHROMATES/irradiation; DICHROMATES/thermal neutrons; INDIUM/chromium; INDIUM/oxidation; INDIUM/solutions; ANNEALING; CHROMATES; IRRADIATION; CHROMIUM; INDIUM; OXIDATION; SOLUTIONS; DICHROMATES; POTASSIUM COMPOUNDS; SALTS; SODIUM COMPOUNDS

26795 (N–89-15731) **Linear response theory for annealing of radiation damage in semiconductor devices. Summary report.** Litovchenko, V. Catholic Univ. of America, Washington, DC (USA). Dec 1988. 19p. (NASA-CR–184584; NAS–1.26:184584). Available from NTIS, PC A03/MF A01.

A theoretical study of the radiation/annealing response of MOS ICs is described. Although many experiments have been performed in this field, no comprehensive theory dealing with radiation/annealing response has been proposed. Many attempts have been made to apply linear response theory, but no theoretical foundation has been presented. The linear response theory outlined here is capable of describing a broad area of radiation/annealing response phenomena in MOS ICs, in particular, both simultaneous irradiation and annealing, as well as short- and long-term annealing, including the case when annealing is nearing completion. For the first time, a simple procedure is devised to determine the response function from experimental radiation/annealing data. In addition, this procedure enables us to study the effect of variable temperature and dose rate, effects which are of interest in spaceflight. In the past, the shift in threshold potential due to radiation/annealing has usually been assumed to depend on one variable: the time lapse between an impulse dose and the time of observation. While such a suggestion of uniformity in time is certainly true for a broad range of radiation annealing phenomena, it may not hold for some ranges of the variables of interest (temperature, dose rate, etc.). A response function is projected which is dependent on two variables: the time of observation and the time of the impulse dose. This dependence on two variables allows us to extend the theory to the treatment of a variable dose rate. Finally, the linear theory is generalized to the case in which the response is nonlinear with impulse dose, but is proportional to some impulse function of dose. A method to determine both the impulse and response functions is presented.

26796 Method for the preparation of novel polyacetylene-type polymers. Zeigler, J.M. To Dept. of Energy. USA Patent Application 7-118,076. 9 Nov 1987. 39p. DOE Contract AC04-76DP00789. Order Number DE89010950/JAW. Available from NTIS, PC A03 - OSTI.

Polymerization of acetylenic monomers is achieved by using a catalyst which is the reaction product of a tungsten compound and a reducing agent effective to reduce W(VI) to W(III and/or IV), e.g., WCl_6-(organo-Li, organo-Mg or polysilane). The resultant silylated polymers are of heretofore unachievable high molecular weight and can be used as precursors to a wide variety of new acetylenic polymers by application of substitution reactions. 1 tab.

26797 Water-soluble conductive polymers. Aldissi, M. To Dept. of Energy. USA Patent Application 7-155,450. 12 Feb 1988. 16p. DOE Contract W-7405-ENG-36. Order Number DE89010809/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Polymers which are soluble in water and are electrically conductive. The monomer repeat unit is a thiophene or pyrrole molecule having an alkyl group substituted for the hydrogen atom located in

the beta position of the thiophene or pyrrole ring and having a surfactant molecule at the end of the alkyl chain. Polymers of this class having 8 or more carbon atoms in the alkyl chain exhibit liquid crystalline behavior, resulting in high electrical anisotropy. The monomer-to-monomer bonds are located between the carbon atoms which are adjacent to the sulfur or nitrogen atoms. The number of carbon atoms in the alkyl group may vary from 1 to 20 carbon atoms. The surfactant molecule consists of a sulfonate group, or a sulfate group, or a carboxylate group, and hydrogen or an alkali metal. Negative ions from a supporting electrolyte which may be used in the electrochemical synthesis of a polymer may be incorporated into the polymer during the synthesis and serve as a dopant to increase the conductivity.

26798 Method of protecting surfaces from abrasion and abrasion resistant articles of manufacture. Hirschfeld, T.B. To Dept. of Energy. USA Patent Application 7-204,432. 9 Jun 1988. 32p. DOE Contract W-7405-ENG-48. Order Number DE89010798/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Surfaces of fabricated structures are protected from damage by impacting particulates by a coating of hard material formed as a mass of thin flexible filaments having root ends secured to the surface and free portions which can flex and overlap to form a resilient cushioning mat which resembles hair or fur. The filamentary coating covers the underlying surface with hard abrasion resistance material while also being compliant and capable of local accommodation to particle impacts. The coating can also function as thermal and/or acoustical insulation and has a friction reducing effect. 11 figs.

26799 Electronic-carrier-controlled photochemical etching process in semiconductor device fabrication. Ashby, C.I.H.; Myers, D.R.; Vook, F.L. To Dept. of Energy. USA Patent Application 7-207,487. 16 Jun 1988. 14p. DOE Contract AC04-76DP00789. Order Number DE89010799/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An electronic-carrier-controlled photochemical etching process for carrying out patterning and selective removing of material in semiconductor device fabrication includes the steps of selective ion implanting, photochemical dry etching, and thermal annealing, in that order. In the selective ion implanting step, regions of the semiconductor material in a desired pattern are damaged and the remainder of the regions of the material not implanted are left undamaged. The rate of recombination of electrons and holes is increased in the damaged regions of the pattern compared to undamaged regions. In the photochemical dry etching step which follows ion implanting step, the material in the undamaged regions of the semiconductor are removed substantially faster than in the damaged regions representing the pattern, leaving the ion-implanted, damaged regions as raised surface structures on the semiconductor material. After completion of photochemical dry etching step, the thermal annealing step is used to restore the electrical conductivity of the damaged regions of the semiconductor material.

26800 Electrically conductive composite material. Clough, R.L.; Sylwester, A.P. To Dept. of Energy. USA Patent Application 7-209,119. 20 Jun 1988. 14p. DOE Contract AC04-76DP00789. Order Number DE89010967/JAW. Available from NTIS, PC A03 - OSTI.

An electrically conductive composite material is disclosed which comprises a conductive open-celled, low density, microcellular carbon foam filled with a non-conductive polymer or resin. The composite material is prepared in a two-step process consisting of first preparing the microcellular carbon foam from a carbonizable polymer or copolymer using a phase separation process, then filling the carbon foam with the desired non-conductive polymer or resin. The electrically conductive composites of the present invention has a uniform and consistent pattern of filler distribution, and as a result is superior over prior art materials when used in battery components, electrodes, and the like. 2 figs.

26801 (PB–89-147227/XAB) **Non-linear optical properties in composite media. Final report.** Centre de Documentation de l'Armement (CEDOCAR), 75 - Paris (France). Direction des Recherches, Etudes et Techniques. 1987. 27p. (In French). Available from NTIS, PC EE04/MF E04.

A study of nonlinear optical properties in composite media, more particularly in metallic colloids (small metallic spheres a few Angstrom in radius dispersed in a dielectric medium) was made. The phase-conjunction experiments used glass doped with small gold spheres. It was possible to identify several characteristics of the nonlinear response of the glass used and the nonlinear susceptibility of the metallic spheres. This susceptibility is independent of the size of the spheres and is rather high; it is mostly imaginary. When the probe polarization is crossed with respect to those of the two pumps, there remains a non-zero conjugated signal. It was concluded that there are two contributions of opposite signs in the Kerr susceptibility of metallic spheres, as was to be expected from theoretical considerations. This was confirmed by an experimental and theoretical study of the saturation phenomena that accompany absorption and phase conjugation. Experimental results were reproduced very satisfactorily by computations. The mechanisms considered are the cause of phase conjugation in gold-doped glass.

26802 (PB–89-858922/XAB) **Ultraviolet curing of polymer coatings. January 1980-March 1989 (Citations from World Surface Coatings Abstracts). Report for January 1980-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 92p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-862305.

This bibliography contains citations concerning methods, evaluations, and equipment for the ultraviolet curing of polymer coatings. Topics include curable coating compositions, protective and decorative coatings, optical fiber coatings, curing photoinitiators, properties and stabilization of cured coatings, and coating binders. Ultraviolet curable polymer materials for use in the furniture, food, electronics, and automotive industries are considered. Citations concerning printing inks and polyurethane curing are excluded and available as two separate bibliographies. (This updated bibliography contains 195 citations, 45 of which are new entries to the previous edition.)

26803 (UCRL–100133) **Failure characterization of composite materials.** Groves, S.E. Lawrence Livermore National Lab., CA (USA). Jan 1989. 10p. DOE Contract W-7405-ENG-48. (CONF-8905104–1: Army symposium on solid mechanics: mechanics of engineered materials and applications, Newport, RI, US, May 16, 1989). Order Number DE89008662/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of this research is to characterize the three-dimensional failure response of continuous fiber graphite epoxy composite materials. This effort includes the development of a new failure model, generation of the three-dimensional failure data, and an investigation of the dynamic strength behavior. This research represents a continuation of an ongoing project initiated in mid FY87. The primary effort to date has centered on the development of the necessary experimental techniques required to generate the complex failure response of these materials. 5 refs., 3 figs., 1 tab.

26804 Constituent diffusion in a deformable thermoelastic solid. Girrens, S.P.; Smith, F.W. 6p. American Society of Mechanical Engineers, New York, NY (1987). (CONF-8706186–: ASME applied mechanics, bioengineering and fluid engineering conference, Cincinnati, OH, US, June 14, 1987).

Technical Paper 87-APM-16.

Solid mixtures containing initially uniform dilute concentrations of impurity elements may, upon the application of mechanical and thermal loading, develop regions of high impurity concentration that could result in local degradation of material properties. To address these degradation processes, a fully coupled thermomechanical-diffusion theory has been developed to describe the mass transport of mobile constituents driven by gradients in concentration, strain dilatation and temperature in a solid deformable parent material. A finite element code has been assembled to solve plane transient thermomechanical-diffusion problems. The theory presented and the resulting code have been successfully used to model internal hydrogen redistribution in β-phase Ti alloys induced by elastic strain gradients during bending.

26805 Alpha, boron, silicon and iron ion induced current transients in low-capacitance silicon and GaAs diodes. Wagner, R.S. (Mechanical and Electrical Engineering Div., Los Alamos National Lab., Los Alamos, NM (US)); Bordes, N.; Bradley, J.M.;

Maggiore, C.J.; Knudson, A.R.; Campbell, A.B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1578-1584 (Dec 1988). (CONF-880730--: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

High-speed current transient measurements were made over a large range of linear energy transfer (LET), using a wide band 70 GHz (6 ps rise time) sampling oscilloscope on high-resistivity GaAs diodes and 1, 3, and 10 Ω.cm silicon diodes. 3- and 5-MeV alpha particles, 12-MeV boron, 18-MeV silicon and 12- and 100-MeV iron ions incident on these devices produced rise times in the range from about 38 ps to 100 ps depending on LET and device resistivity. Results are compared to the equivalent circuit and phenomenological models.

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Refer also to citation(s) 26220, 26369, 26401, 26515, 27040, 27068, 27069

26806 (CONF-8904181–2) **A scientometric look at the present state of neutron activation analysis and applied nuclear chemistry.** Lyon, W.S. Oak Ridge National Lab., TN (USA). 1989. 11p. DOE Contract AC05-84OR21400. From 40. anniversary symposium of the New Brunswick Laboratory; Argonne, IL, US; April 3, 1989. Order Number DE89010844/JAW. Available from NTIS, PC A03 - OSTI.

A scientometric study of citations and publication data has been made to show the present state of NAA and applied nuclear chemistry as compared to other analytical techniques. 9 refs., 7 tabs.

26807 (DOE/ER/13189–4) **Raman microprobe investigation of molecular structure and organization in the native state of woody tissue: Progress report, July 1, 1987–December 31, 1988.** Atalla, R.H. Institute of Paper Chemistry, Appleton, WI (USA). Jan 1989. 18p. DOE Contract FG02-84ER13189. Order Number DE89010928/JAW. Available from NTIS, PC A03 - OSTI.

The work undertaken in the current period was in two categories. The first was the further optimization of the microprobe, the spectrometers, and the ultrafast laser systems which we acquired in support of this project with the aid of the grant from the DOE University Research Instrumentation Program. The second category was the exploration of cell wall structures using both the microprobe and other investigative techniques. Our preliminary mapping studies confirm our earlier findings that the aromatic rings of the lignin within the cell walls are indeed oriented predominantly parallel to the plane of the cell walls. This confirmation of earlier results is particularly important in view of the observation of the transients mentioned above. 3 refs., 2 figs.

26808 (DOE/ER/13542–3) **Studies of the analyte carrier interface in flow injection analysis: Project report, 1 June 1988–1 February 1989.** Brown, S.D. Delaware Univ., Newark, DE (USA). Dept. of Chemistry. 1989. 19p. DOE Contract FG02-86ER13542. Order Number DE89011547/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goal of this project is the study of rapid multicomponent analysis methods, as applied to transient phenomena. A particular area of interest is the quantitation of reactive systems, flowing systems, and the investigation of chemical reactions that can occur in flow injection analysis. Investigation of these dispersion- controlled chemical reactions requires the development of spatially- selective, real-time methods of multicomponent analysis. Thus, we have examined several possible methods for rapid multicomponent analysis. The following report summarizes work done on this project during the period dating from 1 March 1988 to 31 January 1989. Research has concentrated on five areas. (1) Use of digital filters for the analysis of transient responses in flowing systems; (2) use of minimum entropy-based factor analysis to follow reacting systems; (3) development of fast, robust, adaptive digital filtering methods; (4) use of digital filters on data in domains other than the time domain; and (5) testing of several models for flow dispersion.

26809 (DOE/ID/12422–2) **Membrane separation processes in the petrochemical industry: Part 1: Phase 2, Final summary report, October 31, 1985–September 30, 1987.** Li, N.N.; Funk, E.W.; Chang, Y.A.; Kulkarni, S.S.; Swamikannu, A.X.; White, L.S. Allied-Signal, Inc., Des Plaines, IL (USA). 30 Sep 1987. 146p. DOE Contract AC07-82ID12422. Order Number DE89008053/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report provides an overview of a DOE-funded project with Allied-Signal which focused on developing new membrane technology with potential for energy conservation in the petrochemical industry. Three applications were investigated. The first is the use of membrane for the bulk removal of CO_2 and H_2S from sour natural gas. The second is membrane technology for separation of polar gases such as H_2S and NH_3 from H_2. The third process involved a novel ultrafiltration approach for the energy-efficient recovery of solvent from solvent/heavy oil mixtures. This report summarizes laboratory data, field test and pilot plant studies, and economic assessments. 43 refs., 33 figs., 8 tabs.

26810 (DOE/OR/00033–T422) **An inductively coupled plasma spectrometer for on-line, real-time process gas analysis.** McCarty, D.L. II. West Virginia Univ., Morgantown, WV (USA); Oak Ridge Associated Universities, Inc., TN (USA). 1988. 139p. DOE Contract AC05-76OR00033. Order Number DE89010610/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

On-line, real-time analysis of process gas streams, such as gasification and combustion processes, is becoming increasingly important. This dissertation describes an inductively coupled plasma spectrometer capable of analyzing for trace metals in particulate laden process gases that are injected directly into the ICP torch at high temperatures (500°C) and at high sample flow rates necessary to maintain large particulate (10 to 20 micron) entrainment between the process sampling point and the plasma. The system uses a mixed gas argon-helium plasma, and use of the argon-helium plasma as opposed to a nitrogen, oxygen, or air plasma is defended. Characteristics of argon-helium and helium plasmas operated at very high rf forward energy levels are discussed and compared to the characteristics of an argon plasma operated under normal ICP conditions. Also presented are results of actual on-line testing of the ISP, some detection limits determined for elements in process gas types of streams, and the best emission lines to use for elements in process gas streams. 21 figs., 15 tabs.

26811 (DOE/OR/00033–T423) **Seconday ion mass spectrometry of aromatic compounds in acidic mixtures.** Leibman, C.P. Tennessee Univ., Knoxville, TN (USA). Jun 1988. 183p. DOE Contract AC05-76OR00033. Order Number DE89010611/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The use of acidic liquids and solids to improve the sensitivity of Secondary ion mass spectroscopy (SIMS) for aromatic compounds is investigated. SIMS spectra are obtained from substituted aromatic compounds dissolved in concentrated sulfuric acid (98 wt %). Simultaneously abundant molecular ions and protonated molecules characteristic of dissolved aromatics are observed for several aromatic compound classes including acids, aldehydes, ketones, nitriles, and nitrogen heterocycles. The utility of sulfuric acid as a SIMS matrix for detection of pterins, a group of biologically significant compounds, is demonstrated. Application of LSIMS using sulfuric acid for detection of aromatics adsorbed on substrates is also investigated. Use of acidic metal chlorides for enhanced secondary ion emission is also studied. Metal chlorides used as solid matrices or as additives to liquid matrices do not improve the sensitivity of SIMS for aromatic compounds significantly. 141 refs., 43 figs., 6 tabs.

26812 (DP-MS–88-226) **The application of neutron radioscopy to aluminum-lithium alloy target elements.** Antal, J.J.; Marotta, A.S.; Salaymeh, S.R.; Vasrallo, T.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1988. 5p. DOE Contract AC09-76SR00001. (CONF-890554–2: 3. world conference on neutron radiography, Osaka, JP, May 14, 1989). Order Number DE89007581/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A mutual interest in the characterization and use of aluminum-lithium alloys within the Department of Army and the Department of Energy has led to research in the use of neutron radioscopy for

rapid assessment of the extent of aluminum-lithium-6 alloy in core ends of aluminum-clad alloy target tubes. The Army's low-flux mobile neutron radioscopy system was employed in studies of core-end determination as a model system for possible on-line, in-plant use. A series of core end sections of target tubes containing from 0.1 and 4.6 grams of Li-6 per foot of length were submitted to examination with thermal neutrons imaged with a highly sensitive electronic imaging camera. The system was able to determine the extent of lithium alloy core from the highest concentrations down to about 0.2 g Li-6 per foot within one minute of data collection time. A marked loss of sensitivity at the 0.1 gram per foot level could be recovered by providing higher geometrical resolution in the images obtained, but at the cost of a longer data collection time. Image enhancement techniques were found to be beneficial for decision making at the lower concentration levels, and, when combined with readily available densitometric data, may provide rapid determinations at even the lowest concentrations. 1 fig., 1 tab.

26813 (INIS-BR–1458, pp. 72) **Assessment of geometrical effects on Compton profile measurements.** Gigante, G.E. (Universita La Sapienza, Rome (Italy)); Hanson, A.L. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COMPTON EFFECT/plexiglas; PLEXIGLAS/compton effect; PLEXIGLAS/geometry; COLLIMATORS; PLEXIGLAS; KEV RANGE 10-100; KEV RANGE 100-1000; GEOMETRY; SAMPLE PREPARATION; THICKNESS

26814 (INIS-BR–1458, pp. 150) **Trace element analysis in environmental sciences.** Valkovic, V. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Moschini, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ACCELERATORS/environmental materials; ACCELERATORS/uses; ENVIRONMENTAL MATERIALS/element abundance; ENVIRONMENTAL MATERIALS/quantitative chemical analysis; ACCELERATORS; USES

26815 (INIS-BR–1458, pp. 153) **Determination of total fluorine in dental enamel.** Monadili, A. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France)); Vernois, J.; Isabelle, D.B. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FLUORINE/enamels; FLUORINE/activation analysis; FLUORINE/quantity ratio; FLUORINE; ENAMELS; FLUORINE 18; FLUORINE 19 TARGET; NEUTRONS; NEUTRON REACTIONS; POSITRON DETECTION; SENSITIVITY

26816 (INIS-BR–1458, pp. 157) **Effect of motor exhaust on the distribution of trace elements in mouse organs: a study using energy dispersive x-ray fluorescence technique.** Sudhir Kumar (Panjab Univ., Chandigarh (India)); Surinder Singh; Garg, M.L.; Mehta, D.; Nirmal Singh; Mangal, P.C.; Trehan, P.N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MICE/controlled atmospheres; MICE/organs; ORGANS/element abundance; ORGANS/x-ray fluorescence analysis; EXPOSURE CHAMBERS; IRON; LEAD; MICE; ORGANS; PARTICLES; QUANTITY RATIO

26817 (INIS-BR–1458, pp. 158) **Effect of automobile exhaust on the distribution of trace elements particularly Pb and its modulation with Cu, Zn and Fe supplimentation using EDXRF technique.** Sudhir Kumar (Panjab Univ., Chandigarh (India)); Surinder Singh; Garg, R.R.; Mehta, D.; Garg, M.L.; Nirmal Singh; Mangal, P.C.; Trehan, P.N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LEAD/element abundance; LEAD/organs; LEAD/x-ray fluorescence analysis; MICE/controlled atmospheres; MICE/organs; COPPER; DRINKING WATER; IRON; LEAD; ORGANS; MICE; MODULATION; PARTICLES; ZINC

26818 (INIS-BR–1458, pp. 159) **Diabetes and trace elements.** Koulmanda, M. (Walter and Eliza Hall Inst. of Medical Research, Parkville (Australia)); Chandhri, M.A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELEMENTS/blood; ELEMENTS/diabetes mellitus; ELEMENTS/x-ray fluorescence analysis; X-RAY FLUORESCENCE ANALYSIS/blood; X-RAY FLUORESCENCE ANALYSIS/mice; COMPARATIVE EVALUATIONS; ELEMENTS; BLOOD; INTRAVENOUS INJECTION; NITROSO COMPOUNDS; SACCHARIDES; MICE

26819 (INIS-BR–1458, pp. 160) **Trace elements contents of human fetal liver of 12-22 weeks gestation.** Chaudhri, M.A. (Austin Hospital, Heidelberg (Australia)); Koulmanda, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELEMENTS/liver; ELEMENTS/x-ray fluorescence analysis; X-RAY FLUORESCENCE ANALYSIS/fetuses; X-RAY FLUORESCENCE ANALYSIS/liver; ELEMENTS; LIVER; QUANTITY RATIO; SAMPLE PREPARATION; SENSITIVITY; FETUSES; X-RAY TUBES

26820 (INIS-BR–1458, pp. 161) **Zinc analysis in hair samples of mentally sick males and females.** Sastry, D.L. (Andhra Univ., Visakhapatnam (India). Labs. for Nuclear Research); Raghavaiah, C.V.; Venkateswara Rao, N.; Satyanarayana, G.; Sreekrishna Murty, G.; Chandrasekhar Rao, M.V.S.; Bhuloka Reddy, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X-RAY FLUORESCENCE ANALYSIS/hair; X-RAY FLUORESCENCE ANALYSIS/zinc; ZINC/hair; ZINC/mental disorders; ZINC/x-ray fluorescence analysis; COMPARATIVE EVALUATIONS; EVALUATED DATA; QUANTITY RATIO; HAIR; ZINC; X-RAY SPECTROMETERS

26821 (INIS-BR–1458, pp. 191) **Thermoluminescence dating of a Brazilian cave.** Tatumi, S.H. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Watanabe, S.; Matsuoka, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALCITE/age estimation; NATURAL RADIOACTIVITY/age estimation; BRAZIL; CALCITE; CAVES; GLOW CURVE; THERMOLUMINESCENCE

26822 (INIS-BR–1458, pp. 152) **Development of a nuclear microanalysis method using electron accelerator.** Arruda Neto, J.D.T. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PLUTONIUM 239/isotope ratio; PLUTONIUM 239/tobacco; THORIUM 232/isotope ratio; THORIUM 232/tobacco; URANIUM 235/isotope ratio; URANIUM 235/tobacco; ACCELERATORS; CROSS SECTIONS; DIELECTRIC TRACK DETECTORS; ELECTROFISSION; ELECTRON BEAMS; MEV RANGE 10-100; TOBACCO

26823 (INIS-BR–1458, pp. 192) **Non-destructive dating of paleontologic specimens.** Jesus, A.P. (Centro de Fisica Nuclear, Lisboa (Portugal)); Ribeiro, J.P. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FOSSILS/age estimation; FOSSILS; PIXE ANALYSIS; THORIUM 230; URANIUM 238

26824 (INIS-BR–1458, pp. 216) **Study of the resonant photoionization of elements with a Nd:YAG pumped dye laser, for analytical applications.** Gobert, O. (France); Gelin, P.; Inglebert, R.L.; Dubreuil, B.; Debrun, J.L. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MASS SPECTROSCOPY/alloys; MASS SPECTROSCOPY/chemical analysis; MASS SPECTROSCOPY/dye lasers; ALLOYS; PHOTOIONIZATION; RESONANCE ABSORPTION; SENSITIVITY

26825 (INIS-BR–1458, pp. 218) **Chemical analysis using X-rays induced by low energy protons.** Oliver, A. (Universidad Nacional Autonoma de Mexico, Mexico City); Rickards, J.; Miranda, J.; Zironi, E.P.; Aldape, F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PIXE ANALYSIS/proton beams; PIXE ANALYSIS/uses; THIN FILMS/pixe analysis; THIN FILMS/thickness; CROSS SECTIONS; IONIZATION; KEV RANGE 100-1000; USES; THICKNESS; VAN DE GRAAFF ACCELERATORS

26826 (INIS-BR–1458, pp. 219) **Theoretical approach to particle-size measurement and particle-size correction in analysis of ore slurries by XRF spectrometry.** Lankosz, M. (Institute of Physics and Nuclear Techniques, Krakow (Poland)); Holynska, B. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X-RAY FLUORESCENCE ANALYSIS/particle size; X-RAY FLUORESCENCE ANALYSIS/slurries; ACCURACY; CORRECTIONS; FLOTATION; MULTI-ELEMENT ANALYSIS; ORE PROCESSING; SLURRIES

26827 (INIS-BR–1458, pp. 262) **Determination of iridium concentrations in sedimentary rocks and in the geological standard PCC-1 by radiochemical neutron activation analysis.** Armelin, M.J.A. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Vasconcellos, M.B.A.; Pereira, E.B.; Sircilli Neto, F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALIBRATION STANDARDS/element abundance; CALIBRATION STANDARDS/iridium; CALIBRATION STANDARDS/activation analysis; SEDIMENTARY ROCKS/element abundance; SEDIMENTARY ROCKS/iridium; SEDIMENTARY ROCKS/activation analysis; IRIDIUM; NEUTRONS

26828 (INIS-BR–1458, pp. 217) **External beam charge particle activation analysis (CPAA)- a method for trace elemental determination in liquids.** Raghunatha Rao, V. (North Eastern Hill Univ., Shillong (India) Dept. of Physics); Khathing, D.T.; Chowdhury, D.P.; Gangadharan, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ACTIVATION ANALYSIS/irradiation procedures; METALS/activation analysis; PETROLEUM/activation analysis; METALS; PETROLEUM; SENSITIVITY

26829 (INIS-BR–1458, pp. 221) **Method of XRF spectrochemical analysis based on some geometrical properties of the X-ray fluorescent intensity.** Fernandez, J.E. (Cordoba Univ. (Argentina). Facultad de Matematica, Astronomia y Fisica); Rubio, M.; Sanchez, J.H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

STEELS/x-ray fluorescence analysis; X-RAY FLUORESCENCE ANALYSIS/geometry; X-RAY FLUORESCENCE ANALYSIS/illuminance; CHEMICAL COMPOSITION; DATA COVARIANCES; STEELS; GEOMETRY; ILLUMINANCE

26830 (INIS-SU–37/A, pp. 3-11) **Nuclear microanalysis.** Storizhko, V.E. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Comparison of analytical possibilities of physical methods of local analysis of the material composition and structure is reviewed. Possibilities of the following methods: mass-spectrometry of secondary ions, electron Auger-spectroscopy, X-ray spectral microanalysis, X-ray photoelectron spectroscopy, X-ray fluorescent analysis, laser spectra and mass-spectral analysis and methods of nuclear microanalysis, are considered. Comparative characteristics of nuclear-physical methods of expressive nondestructive analysis of prompt radiation of nuclear reactions, backscattering of charged particles and characteristic X radiation are presented. 64 refs.; 1 tab.

26831 (INIS-SU–37/A, pp. 46-50) **Study on the multicomponent thin films by the Rutherford backscattering method.** Bulatov, N.N.; Gusinskij, G.M.; Osetinskij, G.M. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Element composition and its change in depth in multicomponent thin films based on titanium, zirconium, lanthanum and lead oxides supported on the quartz glass are studied by the spectrometry methods of Rutherford backscattering. Using accelerated protons and α-particles with 3 MeV energies and nitrogen-14 ions with 14.5 MeV energy, it becomes possible to obtain titanium, zirconium, lead and partially lanthanum concentration distribution profiles and to study their dependence on high-temperature annealing. 4 refs.; 6 figs.; 1 tab.

26832 (INIS-SU–37/A, pp. 61-64) **Using radiative capture reactions for study on the element composition and the depth distribution of alloying additions in metals.** Antuf'ev, Yu.P. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Dikij, N.P.; Zabolotnyj, V.D.; Litvinenko, A.S.; Matyash, P.P.; Storizhko, V.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh

Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Application of electrostatic accelerators with energy spread <300 eV to investigate the profiles of alloying impurities in a solid with the depth resolution of 5...10 nm is described. Narrow resonances of reactions $^{40}Ar(p,\gamma)^{41}K$, $^{27}Al(p,\gamma)^{28}Si$, $^{15}N(p,\alpha\gamma)^{12}C$, $^{52}Cr(p,\gamma)^{53}Mn$ and $^{48}Ti(p,\gamma)^{49}V$ at 1101.8, 991.88, 429, 1005, 1007 keV energy are used. Detection limits varied from 0.2 to 0.001 mas %. The regulation method for the calculation of impurity profiles in depth according to the experimental yield of nuclear reactions, is described. It is compared with alternative methods for study on spatial distributions of alloying atoms near surface. 11 refs.; 5 figs.

26833 (INIS-SU–37/A, pp. 67-70) **Determination of fluorine distribution profile in optical glass by nuclear analysis methods.** Mashkov, Yu.G. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Zalyubovskij, I.I.; Koshchij, E.I.; Tsymbal, V.A.; Sarana, V.D.; Sushko, V.P.; Pshenitsyn, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Measurements of chemical composition and fluorine distribution profile in two types of optical glasses LK-1 and LK-3 are carried out at the Kharkov State University electrostatic accelerator. When comparing with the synthetic composition, the real content of LK-1 and LK-3 glasses by all reliably identified elements is turned out to be similar to experiment error limits. The fluorine distribution profile of the depth is determined by means of the $^{19}F(p,\alpha\gamma)^{16}O$ resonance nuclear reaction. It is detected that the fluorine concentration jump in LK-1 glass samples is shifted inside the sample at a distance of 0.6 μm, and in samples of LK-3 glasses - at a distance of 1.4 μm from the surface. The accuracy of concentration determination in the depth was not less than 0.05 μm. The presence of the fluorine concentration jump near the LK-1 glass surface explains possibly the wave-guide effect observed in these glasses by the method of resonance excitation of waveguide modes. 6 refs.; 5 figs.

26834 (INIS-SU–37/A, pp. 71-73) **Analysis of heavy elements by the K serie characteristic X-ray radiation method.** Levenets, V.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Kondrat'eva, T.N.; Severin, N.F.; Shchur, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Possibilities of content analysis in objects of heavy elements by the K-series characteristic X radiation method are studied. The expression for characteristic X radiation yield is shown to be simplified due to relatively high energy of radiation monitored differing from application of the L-series; it permits to carry out analysis by the absolute and simplified relative method. Experimental verification of the expressions obtained is carried out. 7 refs.; 2 figs.; 1 tab.

26835 (INIS-SU–37/A, pp. 74-76) **On determination of tantalum trace amounts in ores using the proton excited monochromatic X-radiation source.** Kvaratskheli, Yu.K. (BNIIKhT, Moscow (USSR)); Matyushin, A.P.; Severin, N.F.; Ekhichev, O.I.; Levenets, V.V.; Chumachenko, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

An experimental facility to carry out element analysis by the px, x method is described, application of this facility to carry out ore materials analysis for tantalum content is studied. Effects of different methods for sample preparing on analytical parameters are investigated. Works are carried out using standard samples. The value of the tantalum determination limit -$8x10^{-4}$%, is obtained. The possibility of obtaining less values of determination limit is concluded. 3 refs.; 2 figs.; 1 tab.

26836 (PB–89-148076/XAB) **Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. First Update. (3rd edition).** Friedman; Sellers. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. Jan 1988. 771p. (EPA–530/SW-846.3-1). Available from NTIS, PC A99/MF E04.

See also PB–88-239223.

The proposed Update is for Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition. Attached to the report is a list of methods included in the proposed update indicating whether the method is a new method, a partially revised method, or a totally revised method. Do not discard or replace any of the current pages in the SW-846 manual until the proposed update I package is promulgated. Until promulgation of the update package, the methods in the update package are not officially part of the SW-846 manual and thus do not carry the status of EPA-approved methods. In addition to the proposed Update, six finalized methods are included for immediate inclusion into the Third Edition of SW-846. Four methods, originally proposed October 1, 1984, will be finalized in a soon to be released rulemaking. They are, however, being submitted to subscribers for the first time in the update. These methods are 7211, 7381, 7461, and 7951. Two other methods were finalized in the 2nd Edition of SW-846. They were inadvertantly omitted from the 3rd Edition and are not being proposed as new. These methods are 7081 and 7761.

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Refer also to citation(s) 26316, 26398, 26403, 26421

26837 (AD-A–202479/2/XAB) **Microsensor data-base search MSRCH. User's guide. Technical report, May-September 1987.** Davis, D.M.; Miller, R.E. Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA). Nov 1988. 182p. (CRDEC-TR–010). Available from NTIS, PC A09/MF A01.

MSRCH is a search routine that was written at the U.S. Army Chemical Research, Development and Engineering Center (CRDEC) for use on both the VAX 11/780 and AT&T 3B2 computer systems. The program was developed as one method of easily handling the large amount of data being accumulated on microsensors. Microsensors have the promise of being extremely sensitive detectors for chemical warfare agents, and the amount of data being accumulated grows by leaps and bounds every day. This manual was written to provide those persons working in the microsensor field, an explanation of the MSRCH software.

26838 (DOE/ER/01198–T34) **Synthesis and characterization of Group 4 organometal oxide complexes.** Babcock, L.M. Illinois Univ., Urbana, IL (USA). 1988. 168p. DOE Contract AC02-76ER01198. Order Number DE89010944/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The organometallic substituted Keggin polyoxoanions $[\eta^5-C_5(CH_3)_5]MPW_{11}O_{39}[(n-C_4H_9)_4N]_4$, M = Ti(1), Zr(2), or HF(3), were prepared by reaction of $[\eta^5-C_5(CH_3)_5]MCl_3$ with the lacunary Keggin heteropolyanion $\alpha-H_3PW_{11}O_{39}[(n-C_4H_9)_4N]_4$. Infrared data indicated that complexes 2 and 3 have a normal Keggin structure however complex 1 has a distorted structure. Based-assisted hydrolysis of $[\eta^5-C_5(CH_3)_5]MCl_3$, M = Zr or Hf in THF solution gave $\{[\eta^5-C_5(CH_3)_5]MCl\}_3O(OH)_3Cl$, M = Zr(4) or Hf(5), and $\{[\eta^5-C_5(CH_3)_5]MCl\}_3O(OH)_4$, M = Zr(6) or Hf(7). The crystal structure of 6, determined by Dr. Victor Day at Crystalytics Company in Lincoln, NB, revealed a trimer of metals capped on one side by an oxygen atom and on the other side by a hydroxyl ligand with the three edges bridged by hydroxyl ligands. The hydrolysis of

$[\eta^5-C_5(CH_3)_5]TiCl_3$ resulted in the formation of a six membered titanium oxygen ring $\{[\eta^5-C_5(CH_3)_5]TiClO\}_3$, 8. Hydrolysis in the presence of base has produced a tetrameric ligand stabilized titanoxane complex, $\{[\eta^5-C_5(CH_3)_5]Ti\}_4O_6$, 9. 140 refs., 20 figs., 7 tabs.

26839 (DOE/ER/13362–T1) **[Theoretical and experimental investigations of fluctuation thermodynamic properties of liquid solutions]: [Final technical report].** O'Connell, J.P. Florida Univ., Gainesville, FL (USA). Dept. of Chemical Engineering. [1989]. 4p. DOE Contract FG05-85ER13362. Order Number DE89010642/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During the period of the contract, April 1985 to August 1988, fluctuation theory has been developed for analysis and application to strongly nonideal liquid mixtures including electrolytes. The objectives were (1) to complete a theoretical basis for properties of liquids that is rigorous and leads to useful correlations and (2) to establish a formulation and a data base for use in sensitive comparisons with models for strongly nonideal liquids. The results can be applied to process design for energy-related processes including fossil fuel recovery, high-pressure reaction and separation systems (e.g., coal conversion, petrochemical hydrogenation), energy storage devices, extraction and crystallization (e.g., hydrometallurgy), industrial waste processing and geologic systems for geothermal power production and mining.

26840 (DOE/ER/13617–3) **Selective transformation of carbonyl ligands to organic molecules: Progress report, 1 September 1986–31 August 1989.** Cutler, A.R. Rensselaer Polytechnic Inst., Troy, NY (USA). 18 Apr 1989. 36p. DOE Contract FG02-86ER13617. Order Number DE89011226/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Studies on anionic phosphido alkyl and acetyl complexes $Cp(CO)(PPh_2)Fe-R^-$ (1) and $In(CO)(PPh_2)Fe-R^-$ (2) [R = CH_3 (a), $COCH_3$ (b); In = η^5-indenyl] and their neutral phosphine derivatives $Cp(CO)(PPh_2H)Fe-R$ (3) and $In(CO)(PPh_2H)Fe-R$ (4) are complete. Attempts to carbonylate 1a and 2a to 1b and 2b failed; also, 3a and 4a resist carbonylation. Reacting 1b with MeI affords a neutral PPh_2Me acetyl compound 5, whereas $MeOSO_2CF_3$ gives the Fischer carbene complex $Cp(PPh_2)(CO)Fe=C(OMe)CH_3$ (6). Carbene 6 isomerizes to 5 at room temperature. Reaction conditions have been optimized for tenerating vinylidene compounds $In_2(CO)_3Fe_2$ μ-(C = CHR) from $InFe(CO)_2^-$ and $In(CO)_2Fe-CH_2R$ (R = H, Me, OMe). The bimetallic carbonylation procedure for converting $Fp^-(Li^+, Na^+, PPN^+)$ and $In(CO)_2Fe-CH_3$ to $InCp(CO)_3Fe_2(COCH_3^-)$ and then regioselectively to $FpCOCH_3$ (1 atm CO) has been optimized. Studies are finished on the diastereofacial selectivity observed during reduction of the alkoxycarbenes $Cp[P(OR)_3](CO)Fe=C(OCH_3)CH_3^+$ (R = Me, Ph) with borohydride reagents R_3BH^- (Li^+, Na^+, K^+) and with $(PPh_3CuH)_6$. A survey of the Rh(I)-catalyzed hydrosilation of a variety of iron acyl complexes has been concluded.

26841 (DOE/ER/13626–3) **Morphological aspects of surface reactions: Progress report, January 1988–December 1988.** White, J.M. Texas Univ., Austin, TX (USA). Dept. of Chemistry. Apr 1989. 6p. DOE Contract FG05-86ER13626. Order Number DE89011484/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Progress is reported in the following areas: (1) thin films of metals on metals, (2) potassium activation of adsorbates, (3) thermal chemistry of alkyl halides on metals, and (4) reactions of silica-bound rhodium complexes. 4 refs.

26842 (LBL–25554) **Concepts in surface science and heterogeneous catalysts.** Nix, R.M.; Somorjai, G.A. Lawrence Berkeley Lab., CA (USA). Jul 1988. 68p. DOE Contract AC03-76SF00098. (CONF-8808219–1: 6. international congress on quantum chemistry, Jerusalem, IL, August 21, 1988). Order Number DE89010679/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The development and application of surface sensitive techniques over the last two decades has greatly improved our understanding of surface phenomena at the molecular level. From this newly acquired vast data base new concepts have emerged and it is the purpose of this paper to review those that relate most directly to the chemical properties of surfaces. Concepts concerned with the structure of clean and adsorbate-covered surfaces, the nature of the surface chemical bond, the dynamics of gas-surface interactions, surface chemical reactions and catalytic processes are presented and illustrated with examples from the recent literature. 139 refs., 28 figs.

26843 (RF/PRC/T–8/86) **High temperature/high pressure solubility studies in the systems $BaSO_4$ - NaCl - H_2O and $SrSO_4$ - NaCl - H_2O.** Froeyen, A.J.; Mohn, M.; Schulien, S. Rogalandsforskning, Stavanger (Norway). Jun 1986. 104p. Order Number DE88757321/JAW. Available from NTIS (US Sales Only), PC A06.

The solubilities of $BaSO_4$ and $SrSO_4$ have been determined in NaCl solutions of 0.1 M, 0.5 M, 1.0 M, 1.5 M, and 2.0 M ionic strength for the temperature 80, 100, and 120^{0C} and the pressures 0.1 MPa (0 psig), 20.7 MPa (3000 psig), and 41.4 MPa (6000 psig). The experimental results confirm the general trend in solubility dependencies for both $BaSO_4$ and $SrSO_4$ also in the high temperature/high pressure range: increasing ionic strength results in a pronounced increase in solubilities for $BaSO_4$ and $SrSO_4$, a rise in pressure from 0.1 to 41.4 MPa causes slight increase in solubilities for both sulfates and an increase in temperature from 80 to 120^{0C} leads to an increase in $BaSO_4$ solubility. Calculation of the solubility products for $BaSO_4$, reveals an increase from 1.1 x $0_1$0-10 in pure water at 25^{0C} and 0.1 MPa to 5.1 x 10^-8in 2.0 M NaCl brines at 120^{0C} and 41.4 MPa. For $SrSO_4$, this increase is less distinct, the solubility product increasing from 2.8 x 10^-7in pure water under normal conditions of 18.2 x 10^-7at 100^-0C/41.4 MPa and 16 x 10^-7at 120^{0C}/41.4 MPa in 2 M NaCl brines. A description of the high temperature/high pressure experimental set-up, designed and constructed for this study is given. The study also includes a short discussion of scale prediction methods concerning both $BaSO_4$ and $SrSO_4$ scale formation.

26844 (SSA–1988-TS-9, pp. 31-32) **Development of preparations of cysteamine or WR 1065 fixed on an ion-exchange resin for obtaining a sustained radioprotection by oral way.** Fatome, M. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Laval, J.D.; Stener, F.; Touchard, F. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Cysteamine or WR 1065 have been fixed on a cation-exchange resin. The influence of their concentrations, the measure time, the volume, the buffer medium and the pH have been studied. The coating of the complex by ethylcellulose has been developed. Besides the low quantity delivered to mice, a slight and extended radioprotection has been observed after oral administration of the preparations.

26845 Thermodynamics of aqueous uranyl sulfate to 559 K. Yang, J. (Lawrence Berkeley Lab., CA (USA)); Pitzer, K.S. *Journal of Solution Chemistry (USA),* 18(2): 189-199 (Feb 1989). DOE Contract AC03-76SF00098.

A comprehensive treatment of the thermodynamic properties of aqueous UO_2SO_4 to 559 K is presented. This system has the unusual property of liquid-liquid phase separation above its critical temperature of 559 K. The equations for criticality and for phase equilibria in the molality system are developed. The factors leading to this phase separation are discussed as well as the approximations inherent in their equation because of incomplete information.

26846 Aqueous solubilities of praseodymium europium, and lutetium sulfates. Rard, J.A. (Lawrence Livermore National Lab., CA (USA)). *Journal of Solution Chemistry (USA),* 17(6): 499-517 (Jun 1988). DOE Contract W-7405-ENG-48.

The aqueous solubilities of finely divided $Pr_2(SO_4)_3$ x $8H_2O$(cr), $Eu_2(SO_4)_3$ x $8H_2O$(cr), and $Lu_2(SO_4)_3$ x $8H_2O$(cr) have been measured as a function of time at 25^0C using isothermal saturation. Solubilities of the latter two salts showed a steady decrease with time, whereas $Pr_2(SO_4)_3$ x $8H_2O$(cr) showed no such variation within the accuracy of the determinations. The turbidities of these filtered saturated solutions also decreased with time, and indicate that some colloidal rare earth sulfates were present. These colloidal particles (< 0.2 μ m) have a large surface area, which contributes

to the Gibbs energy of the solid phase, thus giving rise to enhanced solubilities. The micro-particles also growth with time, thereby reducing the surface area contribution to the Gibbs energy and also leaving fewer particles to pass through the filters. Extrapolation of solubilities to infinite time gives the solubilities of microcrystalline $Eu_2(SO_4)_3 \times 8H_2O$ and $Lu_2(SO_4)_3 \times 8H_2O$. Previous solubility data for $Lu_2(SO_4)_3$, at 20 and 40°C, yield an interpolated value at 25°C that is about 30% low. Densities were also measured at several concentrations of each salt.

26847 Solubilities of families of heterocyclic polynuclear aromatics in organic solvents and their mixtures. Coon, J.E. (Louisiana State Univ., Baton Rouge (USA)); Sediawan, W.B.; Auwaerter, J.E.; McLaughlin, E. *Journal of Solution Chemistry (USA),* 17(6): 519-534 (Jun 1988). DOE Contract FG22-84PC70784.

The solubilities of anthracene, acridine, xanthene, thioxanthene, carbazole, dibenzofuran, and dibenzothiophene have been experimentally determined in benzene, cyclohexane, thiophene, and pyridine from ambient temperature to approximately 440 K. The results have been correlated using the classical equation for solid-liquid solubility to obtain the experimental activity coefficient of the solute in the solvent. These experimental activity coefficients have been regressed, using three common solution models, to find the binary interaction parameters needed in those models. The solubilities of biphenyl, dibenzofuran, and dibenzothiophene have been experimentally determined in five binary mixtures of the solvents. The experimental activity coefficients have been found and compared to the values predicted by the four solution models, using the binary interaction parameters obtained from the solubilities in the pure solvents and solvent-solvent binary interaction parameters obtained from literature vapor-liquid equilibria data. The effect of substituting various heteroatoms into the ring structure has been discussed.

26848 Thermodynamics of aqueous association and ionization reactions at high temperatures and pressures. Mesmer, R.E. (Oak Ridge National Lab., TN (USA)); Marshall, W.L.; Palmer, D.A.; Simonson, J.M.; Holmes, H.F. *Journal of Solution Chemistry (USA),* 17(8): 699-718 (Aug 1988). DOE Contract AC05-84OR21400.

Electrochemical and electrical conductance cells have been widely used at ORNL over the years to quantitatively determine equilibrium constants and their salt effects to 300°C (EMF) and 800°C (conductance) at the saturation pressure of water (EMF) and to 4000 bars (conductance). The most precise results to 300°C for a large number of weak acids and bases show very similar thermodynamic behavior, which will be discussed. Results for the ionization constants of water, NH_3(aq), HCl(aq), and NaCl(aq), which extend well into the supercritical region, have been fitted in terms of a model with dependence on density and temperature. The entropy change is found to be the driving force for ion-association reactions and this tendency increases (as it must) with increasing temperature at a given pressure. Also, the variation of all thermodynamic properties is greatly reduced at high fixed densities. Considerable variation occurs at low densities. From this analysis, the dependence of the reaction thermodynamics on the P-V-T properties of the solvent is shown, and the implication of large changes in hydration for solutes in the vicinity of the critical temperature will be discussed. Finally, the change in the molar compressibility coefficient for all reactions in water is shown to be the same and dependent only on the compressibility of the solvent.

26849 Activity of NaOH buffered by silicate solids in molten sodium acetate-water at 317°C. Weres, O. (Lawrence Berkeley Lab., CA (USA)); Tsao, L. *Journal of Solution Chemistry (USA),* 17(8): 777-790 (Aug 1988). DOE Contract AC03-76SF00098.

Silica and sodium acetate are present in the steam generator tube sheet crevices of many nuclear power plants. Trace solutes in the condensate are tremendously concentrated in the crevices by boiling. Sparingly soluble sodium silicates and other solids precipitate from the crevice liquid leaving an extremely concentrated molten mixture of water, sodium acetate and other salts. The precipitates buffer the activity of sodium hydroxide in the superheated liquid that remains. The activity of NaOH corresponding to the buffers quartz/sodium disilicate and sodium disilicate/sodium metasilicate at 317°C has been determined experimentally. The sodium hydroxide content of a sodium acetate-water melt buffered by these reactions was determined by chemical analysis, and the corresponding activity of NaOH at temperature was calculated using the recently published Pitzer-Simonson Model of molten salt-water mixtures. The molten mixture of sodium acetate and water plays the role solvent in these experiments and calculations. The free energies of formation of solid sodium silicates at 317°C were also determined. The activity of NaOH corresponding to other silicate and phosphate buffers was calculated using published thermodynamic data and estimated from phase diagrams.

26850 Modeling aqueous solutions near the critical point of water. Morrison, G. (National Bureau of Standards, Gaithersburg, MD (USA)). *Journal of Solution Chemistry (USA),* 17(9): 887-907 (Sep 1988).

The author reviews the thermodynamic properties of a dilute solution near the critical point of the solvent. Two examples are discussed, a solution of a nonelectrolyte and a solution of an electrolyte. The limiting behavior of the electrolyte solutions is modeled with a Debye-Huckel term in the Helmholtz free energy. The partial molar properties, in particular the volume and isobaric thermal expansion are examined in detail. The derivation of these properties is introduced by considering the geometry of the thermodynamic surfaces near to and far from the critical point of the solvent. The author concludes that the properties of solutions near the solvent critical point are dominated by that feature; solution properties cannot be adequately modeled without including the functional forms associated with the critical point.

26851 Extraction of butanol isomers by m-cresol. Arenson, D.R. (Lawrence Berkeley Lab., CA (USA)); Kertes, A.S.; King, C.J. *Journal of Solution Chemistry (USA),* 17(12): 1119-1132 (Dec 1988). DOE Contract AC03-76SF00098.

Equilibrium distribution ratios were measured for the four butanol isomers between aqueous solutions and solutions of m-cresol in n-octane at various concentrations at 25°C. At any fixed extractant concentration, the order of the distribution ratios among the butanol isomers, from highest to lowest, is n > i > s > t. A comparison of the activity coefficients of the isomers in the aqueous and organic phases, the latter calculated from the measured distribution data, suggests that the dominant isomeric effects reside in the aqueous phase. The mass-action-law interpretation of the distribution data indicates a one-to-one stoichiometry of the butanol: cresol adduct for all of the isomers. The apparent stability of the adduct, with heterogeneous formation constant between 1 and 3 $kJ\text{-}mol^{-1}$, decreases with increasing branching of the butanol.

4004 Electrochemistry

Refer also to citation(s) 26647, 26746, 26784, 26848

26852 Thermodynamics of aqueous borate solutions. II. Mixtures of boric acid with calcium or magnesium borate and chloride. Simonson, J.M. (Oak Ridge National Lab., TN (USA)); Roy, R.N.; Mrad, D.; Lord, P.; Roy, L.N.; Johnson, D.A. *Journal of Solution Chemistry (USA),* 17(5): 435-446 (May 1988). DOE Contract AC05-84OR21400.

Potentials for the cell without liquid junction H_2, $Pt/B(OH)_3(m_1)$, $NaB(OH)_4(m_2)$, $MCl_2(m_3)/AgClAg$ with M = Ca^{2+} or Mg^{2+} are reported over a range of ionic strength at 5, 15, 25, 35, 45, and 55°C. Parameters of Pitzer's ion interaction treatment are determined for $Ca(B(OH)_4)_2$ and $Mg(B(OH)_4)_2$ by fitting to the cell results. Apparent association of alkaline earth borates to form the monovalent species $CaB(OH)_4^+$ and $MgB(OH)_4^+$ makes it necessary to use the extended β form of the ion interaction treatment to represent the potentials reported here. Trace activity coefficients of calcium and magnesium borates are tabulated at various temperatures and ionic strengths. The association constants for ion pair formation implied by the values of β for these salts are compared with ion pair formation constants available in the literature.

26853 Thermodynamics of electrolyte mixtures. Activity and osmotic coefficients consistent with the higher-order limiting law for symmetrical mixing. Yang, J. (Lawrence Berkeley Lab., CA (USA)); Pitzer, K.S. *Journal of Solution Chemistry (USA),* 17(10): 909-924 (Oct 1988). DOE Contract AC03-76SF00098.

The parameters for symmetrical mixing of ions of the same sign in the virial-coefficient (Pitzer) system are evaluated from literature data for 25°C in a manner consistent with the higher-order limiting law of Friedman. Twenty-four systems involve cation mixing with a common anion and fourteen involve anion mixing with a common cation. Heat of mixing data were similarly treated in a recent publication; the results give the temperature coefficients of some of these same parameters. The combined results yield the mixing parameters as functions of temperature on a basis both self-consistent and in accord with the limiting law. The results also yield, for a few systems without a common ion, predicted values in good agreement with experimental data.

4005 Photochemistry

Refer also to citation(s) 26784

26854 (DOE/ER/13508–3) **The detection of the ethynyl radical for studies of the chemistry of soot formation in hydrocarbon combustion: [Progress report].** Cornell Univ., Ithaca, NY (USA). School of Applied and Engineering Physics. [1988]. 20p. DOE Contract FG02-86ER13508. Order Number DE89010874/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this research program has been the performance of mass resolved resonance enhanced multiphoton ionization (REMPI) spectroscopy on species of importance in combustion with primary emphasis on the REMPI detection of photolytically produced C_2H. A molecular beam, flash photolysis apparatus equipped with a time-of-flight mass spectrometer was constructed for the production and monitoring of REMPI ions. New electronic states of C_2 and HCO have been discovered with rotationally resolved REMPI spectroscopy. A weak, diffuse REMPI spectrum near 276 nm has been observed and tentatively assigned to the C_2H radical. No other REMPI spectral features attributable to C_2H were observed. 34 refs., 10 figs., 1 tab.

4006 Radiation Chemistry

Refer also to citation(s) 27212, 27213, 27270

26855 (INIS-BR–1458, pp. 138) **Comparison of lyoluminescence and ESR techniques to study the free radical behaviour in a few gamma ray irradiated saccharides subjected to different heat treatments.** Kundu, H. (Bose Research Inst., Calcutta (India)); Tuktuk Sur; Mitra, B.; Roy, S.C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

SACCHARIDES/gamma radiation; SACCHARIDES/heat treatments; SACCHARIDES/lyoluminescence; ELECTRON SPIN RESONANCE; IRRADIATION; MELTING POINTS; RADICALS; SACCHARIDES; LYOLUMINESCENCE; SPECTRA

26856 (INIS-BR–1458, pp. 139) **Lyoluminescence dosimetric technique for the study of viscosity controlled decay of free radical trapping centres in the ice states formed in melting saccharides.** Kundu, H. (Bose Research Inst., Calcutta (India). Dept. of Physics); Tuktuk Sur; Mitra, B.; Roy, S.C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADICALS/viscosity; SACCHARIDES/irradiation; SACCHARIDES/lyoluminescence; ELECTRON SPIN RESONANCE; GAMMA RADIATION; MELTING; RADICALS; VISCOSITY; SACCHARIDES; IRRADIATION; LYOLUMINESCENCE; TRAPPING

26857 (INIS-BR–1458, pp. 232) **EPR studies on irradiated samples of aqueous malononitrile.** Ramos B, S. (Universidad Nacional Autonoma de Mexico, Mexico City); Negron M, A.; Murrieta S, H.; Rosete A, C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NITRILES/aqueous solutions; NITRILES/irradiation; NITRILES/radicals; ELECTRON SPIN RESONANCE; GAMMA RADIATION; NITRILES; IRRADIATION; RADICALS

26858 (INIS-mf–11406, pp. 102) **Pulse radiolysis, a tool for radiation biology studies.** Klapper, M.H. (Ohio State Univ., Columbus (USA)); Faraggi, M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOBIOLOGY/pulse techniques; AQUEOUS SOLUTIONS; RADIOBIOLOGY; RADIOLYSIS

4007 Radiochemistry and Nuclear Chemistry

26859 (KFK–4516) **Plutonium.** Koelzer, W. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit. Mar 1989. 191p. (In German). Order Number DE89764717/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

This report contains with regard to 'plutonium' statements on chemistry, occurrence and reactions in the environment, handling procedures in the nuclear fuel cycle, radiation protection methods, biokinetics, toxicology and medical treatment to make available reliable data for the public discussion on plutonium especially its use in nuclear power plants and its radiological assessment.

4008 Combustion, Pyrolysis, and High-temperature Chemistry

Refer also to citation(s) 26901, 26913

26860 (CMG–R4-01) **Multiphase flash calculation in in-situ combustion simulation.** Chiu, K.W.; Grabowski, J.W. Computer Modelling Group, Calgary, AB (Canada). 1979. 31p. (CE–02539). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents an efficient four-phase (oil-gas-water-solid) flash calculation for use in the in situ combustion simulator now being developed by the Computer Modelling Group. Coke exists only in the solid phase. H_2O is allowed in the gas phase and the liquid-water phase. The equilibrium constants (K-values) are assumed to be functions of P and T only and are independent of composition. Various possibilities to improve the formulation of the flash calculation are suggested and investigated. They include: reduction of the number of components by combining those having the same or very similar K-values; a direct scheme to determine the existence of the liquid-water phase before any iterations are performed; and modification of the form of equation (from $f(Z_g) = 0$ to $Z_g = g(Z_g)$) in order to improve the rate of convergence. Four computer programs (FLASH1, FLASH2, FLASH3, AND FLASH4) have been written with different formulation and number of components. It is found that program FLASH1, which utilizes all optimizations mentioned in this report, is the best among the four. It is about 15% more efficient than program FLASH4, which solves for $\Sigma Y - \Sigma X = 0$ using the standard Newton-Raphson scheme for a nine-component system. 3 refs., 5 figs., 13 tabs.

26861 **Study of the recombination reaction $CH_3+CH_3 \rightarrow C_2H_6$.** Wagner, A.F. (Argonne National Lab., Argonne, IL (US)); Wardlaw, D.M. pp. 147-152 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

A microcanonical variational RRKM rate constant calculation, based on the flexible transition state theory and an adjustable empirical potential energy surface, is compared to measurements of the methyl radical self-recombination rate constant in Ar buffer gas.

The calculations contain two adjustable parameters: a potential parameter α which influences the tightness of the transition state and

26862 Study of the recombination reaction $CH_3 + CH_3 \rightarrow C_2H_6$. Slagle, I.R. (Illinois Institute of Technology, Chicago, IL (US)); Sarzynski, D.; Gutman, D. pp. 141-146 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

METHYL RADICALS/recombination; ACETONE/combustion kinetics; RECOMBINATION; TEMPERATURE DEPENDENCE; ACETONE; MASS SPECTROSCOPY; HIGH TEMPERATURE; PRESSURE DEPENDENCE; PHOTOLYSIS; PHOTOIONIZATION; MEDIUM TEMPERATURE; ARGON

26863 Incineration of liquid hazardous wastes. Sorbo, N.W. (Sandia National Labs., Livermore, CA (US)); Steeper, R.R.; Chang, D.P.Y.; Law, C.K. pp. 221-226 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

Implementation of federal regulations controlling the treatment and disposal of hazardous wastes has stimulated interest in hazardous waste incineration. Many hazardous wastes are organic containing liquids and are candidates for incineration in spray-fired combustors. Proper design of incinerators to handle these materials depends on understanding vaporization and combustion of both sprays and droplets, and on determining the extent of conversion of the hazardous components, potential production of toxic intermediates, and possible flame-out failure modes. Two factors can inhibit robust burning in the combustion of hazardous wastes and thus are the focus of fundamental research: halogenation and low heat of combustion. In the present study the authors have experimentally quantified the vaporization and combustion rates of droplets of pure chlorinated hydrocarbons and their mixtures with n-alkanes. Several insights into the combustion of hazardous wastes were gained. In the following sections the authors present the experimental methodology, results and discussions, and practical implications.

26864 Detailed nonpremixed flamelet modeling. Kelly, J. (Altex Technologies Corp., Los Gatos, CA (US)); Namazian, M.; Schefer, R.W. pp. 420-425 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

A flamelet model has been developed that treats the details of molecular mixing, combustion and NO pollutant formation chemistry in the vicinity of fuel/air interfaces within large-scale turbulent flow structures. The model utilizes a coordinate system fixed to the interface and, through a 122 reaction step chemical kinetic mechanism, determines the variation of species and temperature normal to the interface. The effect of turbulence on flamelet characteristics is determined by a scalar dissipation parameter. Transport to and from the interface is enhanced by increases in scalar dissipation. For large values of scalar dissipation, flamelet peak temperature and NO pollutant formation are reduced and fuel and air can coexist within the flame zone. For very large values, flamelet reactions can be extinguished. Dilution of the fuel and air by cold combustion products reduces the level of scalar dissipation needed to extinguish the flamelets. Molecular radiation does not significantly influence flamelet characteristics.

26865 Stefan flow effects in boundary layer diffusion during carbon particle combustion. Essenhigh, R.H. (Ohio State Univ., Columbus, OH (US)). pp. 508-515 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

The simultaneous solution of the four, one-dimensional diffusion equations, for O_2, N_2, CO_2 and CO, given in this paper, controlling oxygen delivery to a carbon surface, has allowed a direct, independent determination of the adsorption and desorption kinetics of the carbon/oxygen reaction. Solution of the diffusion equations first was necessary to permit sufficiently accurate calculation of the oxygen concentration at the carbon surface as a pre-requisite to the determination of the carbon reaction kinetics. A key factor in the solution was the determination of the Stefan flow effects. The data used to test both the accuracy of the diffusion equations solutions, and to test the adsorption/desorption kinetics, are those obtained previously in cup experiments. Carbon samples at the bottom of a cup held in a furnace were continuously weighted to obtain combustion rates (found to be linear with time). The experiments were repeated at 18 difference temperatures, and at several different cup depths or diffusion film thicknesses at each temperature, yielding a total of nearly 100 rate measurements.

26866 Chaotic oscillations of cool flames. Wang, X.J. (Faculte des Sciences, Univ. Libre de Bruxelles, Campus Plaine, Bruxelles (BE)). *Combustion and Flame (USA)*, 75(1): 107-109 (Jan 1989).

The purpose of the present communication is to suggest, on the basis of a thermokinetic model of the gas-phase combustion of hydrocarbons, that in a spatially homogenous system a cool flame can oscillate chaotically. It is well known that hydrocarbon oxidation can display periodic oscillation in the regime of cool flames. This can be studied conveniently in a continuous-flow stirred tank reactor (CSTR). In such an open system, hot ignition, whenever it occurs, also repeats itself periodically. In addition, there exists another, more complicated type of periodic oscillation in which the ignition peaks are interspersed with the cool flame peaks. The discovery of this mixed-mode oscillation, is of significance because it provides a clear indication that the low-temperature mechanism of cool flames and the high-temperature mechanism of hot ignition are dynamically related. This connection should explain the known two-stage feature of spontaneous ignition.

26867 The density of smoke droplets produced by thermal degradation of organic solids. Lipowicz, P.J. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM (US)); Rothenberg, S.J. *Combustion and Flame (USA)*, 75(2): 217-219 (Feb 1989).

Thermal degradation of organic solids in the absence of flame produces smoke composed of spherical liquid droplets of pyrolyzate derived from the parent material. The density of these droplets is typically not known and is often assumed to be 1 g/cm^3. In this work the author employed a density-measurement technique used previously to measure the density of cigarette smoke droplets. The technique involves the measurement of the mass and volume of individual particles in a Millikan cell. Smoke was generated from milligram samples of material heated in a thermogravimetric analyzer in an atmosphere of air. The materials used were red oak, cellulose, and glucose, and the respective particle densities were found to be 1.30, 1.49, and 1.41 g/cm^3. These densities are significantly greater than unity and approach the densities of the parent materials.

26868 Transfer of F^- in the reaction of SF^- with SOF_4: implications for SOF_4 production in corona discharges. Van Brunt, R.J. (National Bureau of Standards, Gaithersburg, MD (USA)); Sieck, L.W.; Sauers, I.; Siddagangappa, M.C. *Plasma Chemistry and Plasma Processing (USA)*, 8(2): 225-246 (Jun 1988).

The temperature (T) and electric field-to-gas pressure (E/P) dependences of the rate coefficient k for the reaction $SF_6^- + SOF_4 \rightarrow SOF_5^- + SF_5$ have been measured. For $T < 270$ K, k approaches a constant of 2.1×10^{-9} cm^3/s, and for $433 > T > 270$ K, k decreases with T according to k (cm^3/s) = 0.124 exp [-3.3 ln T(K)]. For E/P < V/cm x torr, k has a constant value of about 2.5×10^{-10} cm^3/s, and for 130V/cm x torr > E/P > 60 V/cm x torr, the rate is approximately given by k (cm^3/s) $\sim 7.0 \times 10^{-10}$ exp (-0.022E/P). The measured rate coefficient is used to estimate the influence of this reaction on SOF_4 production from negative, point-plane, glow-type corona discharges in gas mixtures containing SF_6 and at least trace amounts of O_2 and H_2O. A chemical kinetics model of the ion-drift region in the discharge gap is used to fit experimental data on SOF_4 loss mechanism. It is found that the contribution of this reaction to SOF_4 destruction falls considerably below the estimated maximum effect assuming that SF_6^- is the predominant charge carrier which reacts only with SOF_4. The results of this analysis suggest that SF_6^- is efficiently deactivated by

other reactions, and the influence of SF_6^- + SOF_4 on SOF_4 production is not necessarily more significant than that of other slower secondary processes such as gas-phase hydrolysis.

42 ENGINEERING

4202 Facilities and Equipment

Refer also to citation(s) 26295, 26318, 26370, 26378, 26478, 26538, 26648, 26770, 26905, 26947, 27020, 27048, 27052, 27057, 27058, 27555

26869 (AD-A-202497/4/XAB) **Workshop on rotor-dynamic instability problems in high-performance turbomachinery (5th) held in College Station, Texas on May 16-18, 1988. Final report, 22 February-21 November 1988.** Vance, J.M. Texas A and M Univ., College Station, TX (USA). Sep 1988. 451p. Available from NTIS, PC A20/MF A01.

The workshop on rotordynamic instability problems in high-performance turbomachinery was held as scheduled. It included sessions on field experiences, dampers, seals, impeller forces, bearings, and stability.

26870 (AD-A-203035/1/XAB) **Magnetic mapping of current distributions in two-dimensional electronic devices. Annual report, 1 September 1987-1 September 1988.** Wikswo, J.P. Vanderbilt Univ., Nashville, TN (USA). Dept. of Physics and Astronomy. Sep 1988. 4p. Available from NTIS, PC A02/MF A01.

The 4-channel, high-resolution SQUID magnetometer system has been ordered. This system will have a spatial resolution of approximately 1 mm. The motors for the three-axis, non-magnetic positioning system have been obtained after lengthy discussions to eliminate magnetic components from their motors. Assembly of the equipment is required for the prototype sub-millimeter SQUID system. The temperature controller for the existing Janis continuous-flow cryostat, and a Cooke 3-inch vacuum system was obtained. Obtained were all of the analog and digital hardware and presently completing are the software for the microcomputer controls of the temperature controller, the pumping system, and the data-acquisition system. Developed is the analytic models required to interpret two-dimensional magnetic field maps in terms of the current distributions that produce them. The detailed mechanical design was completed for a 6-foot by 5-foot by 3-foot, four-layer, magnetically shielded enclosure.

26871 (CONF-890304–) **ANS third topical meeting on robotics and remote systems: Proceedings.** Savannah River Lab., Aiken, SC (USA). Mar 1989. 91p. DOE Contract AC09-76SR00001. From 3. ANS topical meeting on robotics and remote systems; Charleston, SC, US; March 13, 1989. Order Number DE89010451/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Savannah River Section and the Remote Systems Technology Division of the American Nuclear Society, along with cosponsoring organizations, are pleased to present the proceedings of the Third Topical Meeting on Robotics and Remote Systems. This document contains ?? technical papers that were presented in 12 slide presentation sessions and two interactive poster sessions covering a wide spectrum of technology and applications from basic remote systems to sophisticated mobile robots. This third volume of ANS topical meeting proceedings, along with volumes from two previous very successful meetings at Gatlinburg, Tennessee (1984), and Pasco, Washington (1987), make up an outstanding reference series covering the advancements in robotics and remote handling.

26872 (CONF-890522–4) **Modifying a telerobotic system to include robotic operation by means of dynamic modeling.** Corbett, G.K.; Jansen, J.F.; Kress, R.L.; Noakes, M.W. Oak Ridge National Lab., TN (USA). 1989. 6p. DOE Contract AC05-84OR21400. From International conference on robotics and automation; Scottsdale, AZ, US; May 14, 1989. Order Number DE89003119/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The goal of this study was to implement a robotic mode for the Advanced Servomanipulator (ASM), a six-degree-of-freedom master/slave teleoperator. To implement a robotic mode on a system designed for teleoperation, the effects of any change in the control schemes must be completely understood. One way to study the impact of potential modifications is to develop a model of the system. This approach is the one taken in this study. A detailed full-arm model was developed by first creating a model for individual joints of the manipulator and then incorporating each of the joint models into a single full-arm model, including link inertias and kinematic cross-coupling. Parameters were identified for each joint model to provide a match between simulated and actual responses to a pulse input. The full-arm model was tested by comparing the simulated and actual response of the ASM to simultaneous sine-wave inputs to each joint, using the model parameters identified on a joint-by-joint basis. The full-arm model was able to characterize effectively the ASM system response for the inputs studied. Robotic-mode control algorithms were tested on both the individual-joint and full-arm models. The results of these simulations indicate that a simplified master/slave control structure is the best candidate for robotic operation. This control structure was added to the ASM. Experimental results demonstrate that the ASM system is capable of repeatable robotic operation. The robotic-mode man-machine interface and data handling system are described in this paper. 12 refs., 3 figs.

26873 (CONF-890522–5) **A comparison of two real-time control schemes for redundant robots with bounded joint velocities.** Euler, J.A.; Dubey, R.V.; Babcock, S.M.; Hamel, W.R. Oak Ridge National Lab., TN (USA). 1989. 16p. DOE Contract AC05-84OR21400. From International conference on robotics and automation; Scottsdale, AZ, US; May 14, 1989. Order Number DE89002974/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A comparison of two real-time control schemes for redundant robots is presented. Both schemes are developed in the framework of resolved rate control, and were presented by the authors in earlier articles. The first scheme is the gradient projection scheme, which determines only the direction of the self motion for the optimization of a scalar performance criterion. The second scheme determines the direction as well as the magnitude of the self motion. However, when the magnitude of the self motion is limited by the hardware bounds on joint velocities, the results obtained using the two schemes are remarkably similar when the computational frequency is high (above 100 Hz). Therefore, the gradient projection scheme, which is computationally more efficient, is recommended. An explanation for the similarity of results is presented. Scheme 1 was implemented in real-time on a Motorola 68020 VME bus-based controller of the seven-degree-of-freedom manipulator at the Center for Engineering Systems Advanced Research (CESAR). 12 refs., 8 figs.

26874 (CONF-8905109–2) **Robust performance of multiple tasks by an autonomous robot.** Beckerman, M.; Barnett, D.L.; Einstein, R.; Jones, J.P.; Spelt, P.D.; Weisbin, C.R. Oak Ridge National Lab., TN (USA). 1989. 9p. DOE Contract AC05-84OR21400. From Workshop on integration of AI and robotic systems; Scottsdale, AZ, US; May 19, 1989. Order Number DE89008718/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

There have been many successful mobile robot experiments, but very few papers have appeared that examine the range of applicability, or robustness, of a robot system. The purpose of this paper is to determine and quantify robustness of the Hermies-IIB experimental capabilities. 6 refs., 1 tab.

26875 (DFVLR-FB–88-54) **Study on thermodynamical and mechanical conditions for pumping low flow rates of liquefied gases to high pressure level.** Nieratschker, W. Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Stuttgart Univ. (Germany, F.R.); Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V. (DFVLR), Stuttgart (Germany, F.R.). Inst. fuer Technische Thermodynamik. 1988. 148p. (In German). Order Number DE89764604/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

High pressure cryogenic liquid pumps handling low boiling liquids are investigated in the very low mass flow range. The cavitation

problem becomes predominant with lower pump capacities caused by the increasing ratio of heat loss to the pump capacity. Based on a mechanical design study a first prototype for low flow rates has been developed and investigated. The amount of incoming heat from the environment and the sealing problems of the reciprocating piston against high pressure occurred as the main problems. A new lifting pump concept and a patented construction promised to offer solutions and further essential advantages. After detailed investigations and improvements the new prototype is operable without being submerged in the cryogenic liquid and has a short instationary cooling period. The realisation of single-staged high pressure cryogenic liquid pumps for low mass flow rates is demonstrated. It appeared that the prevention of cavitation caused by frictional heat between reciprocating piston and cylinder is neither possible nor necessary. (orig.) With 62 refs., 13 tabs., 62 figs.

26876 (EGG-M–14987) **TMI-2 fuel canister and core sample handling equipment used in INEL hot-cells.** McConnell, J.W. Jr.; Shurtliff, W.T.; Lynch, R.J.; Croft, K.M.; Whitmill, L.J.; Allen, S.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1987. 8p. DOE Contract AC07-76ID01570. (CONF-871109–1: International conference on waste management, Hong Kong, HK, November 30, 1987). Order Number DE89011137/JAW. Available from NTIS, PC A02 - OSTI.

This paper describes the specialized remote handling equipment developed and used at the Idaho National Engineering Laboratory (INEL) to handle samples obtained from the core of the damaged Unit 2 reactor at Three Mile Island Nuclear Power Station (TMI-2). Samples of the core were removed, placed in TMI-2 fuel canisters, and transported to the INEL. Those samples will be examined as part of the analysis of the TMI-2 accident. The equipment described herein was designed for removing sample materials from the fuel canisters, assisting with initial examination, and processing samples in preparation for detailed examinations. The more complex equipment used microprocessor remote controls with electric motor drives providing the required force and motion capabilities. The remaining components were unpowered and manipulator assisted. 4 refs., 16 figs.

26877 (LA-UR–89-579) **In-bore structural behavior of 120-mm saboted long rods subjected to axial and lateral accelerations.** Rabern, D.A. Los Alamos National Lab., NM (USA). 1989. 11p. DOE Contract W-7405-ENG-36. (CONF-890585–3: 11. international symposium on ballistics, Brussels, BE, May 9, 1989). Order Number DE89007996/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The methodology and analysis used to characterize the structural performance of a sabot/rod as it is subjected to lateral and axial loading during launch is presented. The method described incorporates both experimental and numerical phases in the evaluation. 9 refs., 10 figs., 2 tabs.

26878 Mounting arrangement for the drive system of an air-bearing spindle on a machine tool. Lunsford, J.S.; Crisp, D.W.; Petrowski, P.L. To Dept. of Energy. USA Patent Application 7-129,208. 7 Dec 1987. 13p. DOE Contract AC05-84OS21400. Order Number DE89010958/JAW. Available from NTIS, PC A03 - OSTI.

The present invention is directed to a mounting arrangement for the drive system of an air-bearing spindle utilized on a machine tool such as a lathe. The mounting arrangement of the present invention comprises a housing which is secured to the casing of the air bearing in such a manner that the housing position can be selectively adjusted to provide alignment of the air-bearing drive shaft supported by the housing and the air-bearing spindle. Once this alignment is achieved the air between spindle and the drive arrangement is maintained in permanent alignment so as to overcome misalignment problems encountered in the operation of the machine tool between the air-bearing spindle and the shaft utilized for driving the air-bearing spindle.

26879 Variable loading roller. Williams, D.M. To Dept. of Energy. USA Patent Application 7-146,644. 21 Jan 1988. 34p. DOE Contract AC05-84OR21400. Order Number DE89010894/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An automatic loading roller for transmitting torque in traction drive devices in manipulator arm joints includes a two-part camming device having a first cam portion rotatable in place on a shaft by an input torque and a second cam portion coaxially rotatable and translatable having a rotating drive surface thereon for engaging the driven surface of an output roller with a resultant force proportional to the torque transmitted. Complementary helical grooves in the respective cam portions interconnected through ball bearings interacting with those grooves effect the rotation and translation of the second cam portion in response to rotation of the first. 14 figs.

26880 (PB–89-858617/XAB) **Tribology: coatings. January 1970-March 1989 (Citations from the COMPENDEX data base). Report for January 1970-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 170p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-863246.

This bibliography contains citations concerning design, evaluation, selection, characterization and failure analysis of tribological coatings. Tribological materials and comparative analyses for coatings are included. Surface studies, methods of application, and effects of the methods of application on the tribological properties of the coatings are also discussed. (This updated bibliography contains 348 citations, 25 of which are new entries to the previous edition.)

26881 (PB–89-859045/XAB) **Sensors and detectors based on superconducting devices. July 1982-February 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-February 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 69p. Available from NTIS PC N01/MF N01.

This bibliography contains citations from conference proceedings concerning gradiometers, magnetometers, and infrared detectors which use superconductors to improve sensitivity. Applications include biomagnetic measurements for medical studies, gravity-wave experiments, geomagnetism and ocean bottom magnetic exploration, galvanometers and voltmeters, and bolometers and radiometers. Some articles refer to design considerations for cooling systems for the sensors and detectors, and fabrication techniques for SQUIDS (superconducting quantum interference devices.) (Contains 115 citations fully indexed and including a title list.)

26882 (PB–89-859276/XAB) **Cryogenic refrigeration. March 1982-March 1989 (Citations from the NTIS data base). Report for March 1982-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 138p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-862941.

This bibliography contains citations concerning the technological development and utilization of cryogenic refrigeration methods and equipment. Performance evaluations of specific systems, equipment descriptions and applications, including the cooling of instrumentation, superconductors, reactor devices, satellites, and other spaceborne vehicles are considered. (This updated bibliography contains 225 citations, 52 of which are new entries to the previous edition.)

26883 (PB–89-859631/XAB) **Superconducting cables: long-distance energy transmission. January 1973-April 1989 (Citations from the NTIS data base). Report for January 1973-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 94p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-859533.

This bibliography contains citations concerning the design, development, and evaluation of superconducting cables and power-transmission lines for long-distance energy transmission. Topics include methods of cryogenic refrigeration and electrical insulation, fabrication and development of niobium alloy conductors, energy loss analysis, and dielectric design techniques for superconducting power-transmission systems. Government research project reports on superconducting technology for electric-power transmission and distribution are included. (This updated bibliography contains 186 citations, 57 of which are new entries to the previous edition.)

26884 (PNL–6861) **Mobile Energy Laboratory Use Plan.** Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 27p. DOE Contract AC06-76RL01830. Order Number DE89010284/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document provides a framework for the use of four Mobile Energy Laboratories (MELs) by federal agencies. These laboratories are made available by the US Department of Energy Federal Energy Management Program (FEMP) to measure and analyze the efficiency of on-site energy conversion, distribution, and end-use application. The MELs are customized passenger buses converted to provide transportation and storage of sophisticated energy monitoring, auditing, and analysis equipment. The MELs also provide mobile work space for specially trained engineers and technicians. One MEL is currently assigned to each of the following agencies: Department of the Army, Department of the Air Force, Department of the Navy, and Department of Energy. Experience over the past five years has indicated the need for centralized MEL administration, application scheduling, test procedure development, user training, and technical oversight. This need is evidenced by increasing requests for MEL use and the economies available by having trained full-time MEL operators and near continuous MEL operation. Other evidence suggests that a regional, rather than Departmental, administration can reduce the costs of MEL relocation.

26885 (SAND–88-2420C) **Long-rod penetration into simulated geological targets at an impact velocity of 3.0 km/s.** Forrestal, M.J.; Piekutowski, A.J.; Luk, V.K. Sandia National Labs., Albuquerque, NM (USA). 1988. 11p. DOE Contract AC04-76DP00789. (CONF-890585–1: 11. international symposium on ballistics, Brussels, BE, May 9, 1989). Order Number DE89006508/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A 50/20-mm, two-stage, light-gas gun launched spherical-nose steel projectiles with 7.1-mm-diameter and 39.1-mm-length to an impact velocity of 3.0 km/s. The projectiles penetrated 115-mm-diameter, simulated geological targets with density of 1700 kg/m^3 that consisted of several grades of sand and a binder. We experimented at normal impacts (θ = 0 degrees) and at oblique impacts (θ = 60 degrees). In-material x-ray photographs at three penetration depths showed the depth, length of eroded rod, and cavity shape. We compared penetration depth vs time data and rod-length vs time data with Tate's eroding rod model and found excellent correlation between measured and predicted results. We also developed approximation closed-form equations for Tate's model from a perturbation analysis. Predictions from the closed-form equations also showed good correlation with measurements. 13 refs., 3 figs., 1 tab.

26886 (SAND–88-2530C) **Identification of error sources in shock data.** Baca, T.J.; Bell, R.G. Sandia National Labs., Albuquerque, NM (USA). 1988. 25p. DOE Contract AC04-76DP00789. (CONF-890592–3: 35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment, Anaheim, CA, US, May 1, 1989). Order Number DE89007655/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Instrumentation error sources are frequently encountered during the measurement of mechanical shock transients. This paper investigates the effects of two common errors: zero shifts and noise spikes. Non-trivial frequency domain manifestations of these errors are noted. Effective methods of identifying these errors are introduced and demonstrated. The significance of the problem is founded on the implications which these errors have on the subsequent analysis of the data using shock response spectra. 6 refs., 13 figs.

26887 (SAND–88-2768) **Causes and control of gas precompression effects on the 25-meter helium/air gun.** Boslough, M.B.; Setchell, R.E.; Anderson, M.U.; Lewis, M.R.; Wackerbarth, D.E. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 53p. DOE Contract AC04-76DP00789. Order Number DE89009716/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Recent experiments making use of quartz stress gauges and radiation pyrometry on the Sandia 25-meter gas gun have shown that, under certain circumstances, gas becomes trapped between the projectile and target and can generate elevated pressures and temperatures in the target before impact. The presence of high temperature compressed gases can lead to a number of other deleterious effects, including ignition of reactive materials, shorting of triggering pins, and interference with light-emission measurements. We have now shown that the gas precompression effect on the target is due primarily to blowby of compressed driver gases past the projectile. By modifying the design of some projectiles, making a minor change in the breech, and changing the starting position of the projectile in the barrel, we can eliminate any significant gas precompression effects on the target. For applications in which precompression is desired, we have found that this effect can be reproducibly controlled. Possible applications include quasi-isentropic compression, light generation for transmission spectroscopy, and adjustment of conditions for shock-induced chemical reactions. 11 refs., 13 figs., 3 tabs.

26888 (SAND–89-0376C) **An analytical study of a vibration test method using extremal control of acceleration and force.** Smallwood, D.O. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. DOE Contract AC04-76DP00789. (CONF-890592–2: 35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment, Anaheim, CA, US, May 1, 1989). Order Number DE89007428/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A vibration test method has been proposed where control is accomplished using extremal control of the force and acceleration at the input to a test item. This proposal is examined with several examples. The method does limit the acceleration input at frequencies where the test item responses tend to be unrealistically large. However, the method's application is not straightforward and care must be taken in the application of the method. 9 refs., 16 figs.

26889 (SAND–89-0537C) **Identification of distributed forces on a structure.** Paez, T.L.; Coleman, R. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. DOE Contract AC04-76DP00789. (CONF-890592–5: 35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment, Anaheim, CA, US, May 1, 1989). Order Number DE89007978/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents a combined analytical and experimental method for establishing a set of equations to evaluate the equivalent forces acting on a structure. The method requires that a finite element model of the structure be established. It further requires that the accelerator responses to the external forces be measured at a number of points on the structure. The equivalent forces established in the analysis are a representation of the actual forces. The equivalent forces concentrate the effects of the external forces at the degrees of freedom where the acceleration responses are measured. 6 refs., 4 figs., 1 tab.

26890 (SAND–89-0538C) **Simple fixture concepts for multi-axis vibration testing.** Paez, T.L.; Buksa, E.J.; Beightol, D. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. DOE Contract AC04-76DP00789. (CONF-890592–4: 35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment, Anaheim, CA, US, May 1, 1989). Order Number DE89007977/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents some simple concepts for fixtures that can be used in two and three-axis vibration testing. Two, two-axis fixtures were built and tested in the laboratory. Test results are shown, and serve to confirm the validity of the concept. Simple methods for extending the concepts for three-axis testing are discussed. 6 refs., 9 figs.

26891 (TKK-KO/ET–30) **Flow characteristics and accuracy of control valve.** Pyoetsiae, J. Helsinki Univ. of Technology, Otaniemi (Finland). Inst. of Energy Engineering. 1989. 41p. (In Finnish). Order Number DE88757331/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The purpose of this work was to examine the flow characteristics and accuracy of control valve. The research was divided into three different parts. At first, flow characteristics of control valve were studied, and general solution was determined for the optimal form of inherent flow characteristic of control valve. The general solution obtained was applied by determining the optimal form of the inherent flow characteristic of the control valve being in flow rate control, while the installed control valve was required constant gain or constant control accuracy. At the second part of the research, a control valve error was determined and the equation of valve inherent flow characteristic was derived by which the optimal accuracy can be reached. In the third part, the modification of the valve inherent flow

characteristic was examined by a position control analogically and digitally carried out.

26892 (UA–9010788) **Development of a knowledge based system for diagnosing electrical faults in mining machinery: Final report for the 1986–1987 SOMED project year.** Novak, T.; Sanford, R.L.; Meigs, J.R. Alabama Univ., University, AL (USA). School of Mines and Energy Development. 1987. 79p. Available from OSTI - School of Mines and Energy Development, Box 6282, The University of Alabama, Tuscaloosa, AL 35487.

Rigorous duty cycles and harsh operating environments contribute to electrical component failures in mining machinery, thus reducing productivity at the working face. This report explains a rule-based expert system utilizing the microcomputer that may assist maintenance personnel in diagnosing electrical faults in the relatively complex electrical circuit of a shuttle car. By gathering information such as voltage and resistance measurements, the user acts as an interface between the machine circuit and expert system to diagnose single component failures caused by open and short circuits. The report also covers the structure of the expert system development tool, Insight 2+, chosen to develop the knowledge base. 16 refs., 12 figs.

26893 (WSRC-RP–89-7) **200 area works engineering fabrication course MM-304.** Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 84p. DOE Contract AC09-89SR18035. Order Number DE89010754/JAW. Available from NTIS, PC A05 - OSTI.

This module is one of many which make up the Maintenance Training Program of the Separations Works Engineering that is directed to developing individuals for safe and efficient performance. This module is designed with a strong emphasis on giving you ample opportunity to practice and demonstrate your developing skill. We recognize that your learning opportunity is greatest when you are offered classroom instruction, instructor demonstrations, practical "hands-on" exercises and personal self-study materials properly fused into a whole. The materials used in this module include resources tailored to match the practices of Separations Works Engineering. The assumption is made that you have the general prerequisite knowledge of basic math and fundamental safety practices, and that you have previously completed fabrication instruction offered by Central Services Training. These course materials have been developed by Aiken Technical College. Upon satisfactory completion of MM-304 at SRP, you will be granted 1 credit hour relating to the Aiken Technical College course number SHM-142.

4203 Lasers

26894 (AD-A–202472/7/XAB) **Transformations of Gaussian light beams caused by reflection in FEL (free electron lasers) resonators. Interim report.** Riyopoulos, S.; Tang, C.M.; Sprangle, P. Naval Research Lab., Washington, DC (USA). 27 Oct 1988. 73p. (NRL-MR–6347). Available from NTIS, PC A04/MF A01.

The transformation of Gaussian radiation beams caused by reflection off mirrors is an important issue for FELs operating as oscillators. The reflected radiation from a single incident Gaussian mode will contain other modes due to the finite mirror size, the deflection of the beam and mismatches in the curvature. A method for analytic computation of the reflection matrix is developed by taking the convolution of the source function at the surface of the mirror with the paraxial propagator. The mirror surface that reflects spherical incoming wavefronts into spherical outgoing is determined analytically. Integral expressions for the reflection coefficients R(mn) sub pq for any incoming mode u sub mn into the outgoing u sub pq are obtained as functions of the deflection angle phi, the reflected beam waist sub 0 and the mirror size. Analytic expansions of the reflection matrix in powers of the diffraction angle theta sub d <<1 are then obtained in both Hermite and Laguerre representations. The cross coupling among vector components of the radiation field, caused by the curvature of the mirror surface, is included. It is shown that the lowest-order contribution to the off-diagonal matrix elements is caused by the finite mirror size. The effects of the mirror curvature and the deflection of the light beam enter the reflection matrix as first-order corrections in theta sub d.

26895 **Phase-conjugate resonator.** Russell, S.D. To Dept. of the Army, Washington, DC (USA). USA Patent Application 7-276,981. 28 Nov 1988. 7p. Available from NTIS, PC A02/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

By incorporating a phase-conjugating process (Stimulated Brillouin Scattering) with a master oscillator power amplifier laser cavity, a new phase-conjugate resonator (PCR) is obtained. The PCR utilizes flashlamp-pumped dye lasers and a resonator cavity that is formed by a 100% mirror on one end and a Stimulated Brillouin Scattering (SBS) cell on the other end. The SBS cell functions as one of the mirrors of the resonator and causes the entire system to operate as a phase-conjugate resonator. The result is vastly improved (an order of magnitude) beam qualities over conventional resonators for large lamp systems.

26896 **Ring laser cavities.** Goldberg, L.; Weller, J.F. To Dept. of the Navy, Washington, DC (USA). USA Patent Application 7-245,176. 16 Sep 1988. 30p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Diffraction limited, single narrow-lobe radiation from a large-area laser is achieved in a system using an external ring-laser cavity to return radiation to the laser via a spatial filter and a Faraday rotator. An antireflectance coating of sufficiently small reflectivity added to the large-area laser converts it into a laser amplifier that provides optical gain in a ring-laser cavity.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 26567, 26716, 27560, 27655

26897 (AD-A–203176/3/XAB) **Incompressible flow-friction coefficients in a simulated heat pipe. Master's thesis.** Manley, D.A. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 96p. (AFIT/GAE/AA–88D-22). Available from NTIS, PC A05/MF A01.

This thesis examines the combined effects of pressure gradients and blowing and suction on frictional forces in a heat pipe with relatively low radial Reynolds numbers. A porous tube is used to simulate the heat pipe and a vacuum pump is used to generate the air flow. By measuring the static pressure variation along the pipe wall and using a one-dimensional, incompressible, numerical model, the frictional forces are obtained and compared to laminar fully-developed theoretical values.

26898 (AERE-R–13283) **Image processing system for fluid studies.** Shand, A.M. UKAEA Harwell Lab. (UK). Engineering Science Div. Jul 1988. 29p. Available from H.M. Stationery Office, London, price Pound 8.75.

A microcomputer-based image processing system has been developed for application to fluid flow studies. Quantitative information is extracted from otherwise qualitative photographic and video recordings, including those obtained in laser light sheet illumination experiments. The system is compact, flexible and readily applicable to practical flow data. After an introduction to image processing, the system is described, and details and results are given of several applications, including neutron radiography of pipe reflooding for water cooled nuclear reactors.

26899 (IEN-DITRA–13/84) **Code for obtaining temperature distribution by finite element method.** Bloch, M. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1984. 32p. (In Portuguese). Order Number DE89610804/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The ELEFIB Fortran language computer code using finite element method for calculating temperature distribution of linear and two dimensional problems, in permanent region or in the transient phase of heat transfer, is presented. The formulation of equations uses the Galerkin method. Some examples are shown and the results are compared with other papers. The comparative evaluation shows that the elaborated code gives good values. (M.C.K.).

26900 (JINR–E-8-88-360) **Characteristics of horizontal two-phase helium flow at low mass velocities.** Filippov, Yu.P.; Mamedov, I.S.; Selyunin, S.Yu. Joint Inst. for Nuclear Research,

Dubna (USSR). 1988. 6p. English Order Number DE88706311/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Presented at the 12. International cryogenic engineering conference, Jul 12-15, 1988, Southampton, UK.

Two-phase helium flows experimental and theoretical exploration results, including data on flow regimes, pressure drop, and void fraction, are presented. The circular, annular, and slot channels are examined. All the considered data are for low mass velocities and near-adiabatic conditions. 6 refs.; 4 figs.; 1 tab.

26901 (LA-UR–89-590) **Improvements of the KIVA-II computer program for numerical combustion.** O'Rourke, P.J.; Amsden, A.A.; Butler, T.D.; McKinley, T.L. Los Alamos National Lab., NM (USA). 1989. 15p. DOE Contract W-7405-ENG-36. (CONF-8905105–1: 3. international conference on numerical combustion, Antibes, FR, May 23, 1989). Order Number DE89007994/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes and illustrates the principal differences between the newly-released KIVA-II and the KIVA computer programs. Both programs are for the numerical calculation of two- and three-dimensional fluid flows with chemical reactions and sprays. Because of improvements to KIVA-II, it is faster, more accurate, and applicable to a wider variety of problems involving combustion and two-phase flow. 28 refs., 4 figs., 2 tabs.

26902 (STF–15A85021) **GPHMT. General plotting of heat and mass transfer.** Oestby, O.; Soerli, K. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Apr 1985. 87p. Order Number DE88757327/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The interactive programme package General Plotting of Heat and Mass transfer (GPHMT) has been developed in order to give the user an easy access to a variety of graphic presentation modes for simulation of problems dealing with heat and mass transfer. The program is capable of handling both stationary and non-stationary problems in one-two-, and three-dimensional space resolution. 13 figs.

4205 Materials Testing

Refer also to citation(s) 26295, 26320, 26496, 26505, 26566, 26677, 26756, 26880, 27039

26903 (DP-MS–89-49) **Basics of ultrasonic testing.** Sprayberry, R.E. Savannah River Lab., Aiken, SC (USA). 1989. 27p. DOE Contract AC09-76SR00001. (CONF-890334–1: Spring conference of the American Society for Nondestructive Testing, Charlotte, NC, US, March 20, 1989; CONF-890482–2). Order Number DE89010465/JAW. Available from NTIS, PC A03 - OSTI.

This paper is an outline of a presentation on the fundamentals of ultrasonic testing. 20 figs. (JF)

26904 (SAND–88-2183C) **A test system for computer controlled thermomechanical fatigue testing.** Jones, W.B.; Schmale, D.T.; Bourcier, R.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 21p. DOE Contract AC04-76DP00789. (CONF-8905112–1: ASTM symposium on the applications of automation technology to fatigue, Kansas City, MO, US, May 22, 1989). Order Number DE89009067/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a computer controlled testing system which is capable of performing thermomechanical fatigue tests. Three different tests have been developed: (i) high temperature compression (HTC) tests in which the gauge length of the specimen is held at constant length and the mechanical strain is totally imposed by the triangular temperature cycle, (ii) high temperature tension (HTT) tests in which the mechanically imposed length change is exactly double the thermally induced length change, and (iii) multiple isothermal deformation (MID) tests for which the deformations occur isothermally and the temperature is changed every half cycle while maintaining constant mechanical strain. The need for these tests is shown by comparing the results of isothermal low cycle fatigue tests with results from TMF for several steels (304 Stainless Steel, 316 Stainless Steel, Alloy 800, and Modified 9Cr-1Mo Steel). We show that universal assumptions of TMF behavior are inappropriate and may lead to non-conservative design rules. Computer controlled TMF tests of the types described here are required to establish the response of each alloy considered for application. 8 refs., 9 figs., 1 tab.

4208 Electronic Circuits and Devices

Refer also to citation(s) 26597, 26782, 26892, 26894, 26895, 27049, 27052, 27053

26905 (CONF-890555–3) **Condition monitoring of machinery using motor current signature analysis.** Kryter, R.C.; Haynes, H.D. Oak Ridge National Lab., TN (USA). 1989. 22p. DOE Contract AC05-84OR21400. From 7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989. Order Number DE89008737/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Motor current signature analysis (MCSA) is a powerful monitoring tool for motor-driven equipment that provides a nonintrusive means for detecting the presence of mechanical and electrical abnormalities in the motor and the driven equipment, including altered conditions in the process "downstream" of the motor-driven equipment. It was developed at the Oak Ridge National Laboratory as a means for determining the effects of aging and service wear systems, but it is applicable to a broad range of machinery. MCSA is based on the recognition that an electric motor (ac or dc) driving a mechanical load acts as an efficient and permanently available transducer by sensing mechanical load variations, large and small, long-term and rapid, and converting them into variations in the induced current generated in the motor windings. These motor current variations are carried by the electrical cables processes as desired. Motor current signatures, obtained in both time and over time to provide early indication of degradation. Successful applications of MCSA technology (patent applied for) include not only motor-operated valves but also pumps of various designs, blowers, and air conditioning systems. Examples are presented briefly, and speculation regarding the applicability of MCSA to a broader range of equipment monitoring and production line testing is also given. 1 ref., 13 figs.

26906 (EGG-EE–8351) **Smart build-in-test using the BITSI technique.** Bergeson, G.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). Feb 1989. 102p. DOE Contract AC07-76ID01570. Order Number DE89010972/JAW. Available from NTIS, PC A06 - OSTI.

This report describes a built-in-test technique called Built-In-Test by Signature Inspection (BITSI) used to pinpoint the source of faults within digital circuits. BITSI is implemented using simple, digital logic which resides on the same printed circuit board as the circuit under test. BITSI is an active technique which does not influence normal operation of the circuit board. When the BITSI logic is activated, it switches the circuit under test off-line, applies a test stimulus to the circuit, and measures circuit response at various test nodes. If the response is abnormal, BITSI will isolate the fault to the circuit node which generated the fault. BITSI has many advantages, including real-time test speed: it is fully automated and self-contained on the printed circuit board under test; it requires no external test equipment; it tests for faults in the test hardware; it is highly reliable and is easily applicable to most digital circuits. 8 refs., 15 figs., 6 tabs.

26907 **Placement accuracy gauge for electrical components and method of using same.** Biggs, P.M.; Dancer, L.K.; Yerganian, S.S. To Dept. of Energy. USA Patent Application 7-119,878. 12 Nov 1987. 20p. DOE Contract AC04-76DP00613. Order Number DE89010951/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Surface mounted electrical components are typically assembled on printed wiring board by automatic machines. It is important that the machines accurately move with respect to both X and Y rotational axes in order to insure that components are positioned precisely on connector pads of the printed wiring board being assembled. In accordance with the instant invention, a gauge is used to facilitate convenient accuracy checks. The gauge is a glass substrate on which grids of 0.005 inch lines are scribed to form location and orientation fields where components are to be placed. The grids are referenced from ether fiducial marks or the edge of the

substrate to establish known positions within the grids. The equipment to be evaluated is programmed to place components in known positions and the components are held in place by tacky adhesive that is sprayed on the substrate prior to placing the components. The accuracy of the component position is then compared to the programmed position by placing the substrate on a light table and observing the component location. If a significant inaccuracy with respect to any of the axes exists, the inaccuracy is apparent because the component is not aligned properly with the grid. If a precise measurement of an axis inaccuracy is desired, a measuring microscope may be utilized. 6 figs.

26908 (SAND–88-2645) **Radiation hardened, optically-triggered thyristor switches: Preliminary data on three device designs.** Hughes, R.C.; Zipperian, T.E.; Weaver, H.T.; Brennen, T.M.; Hammons, B.E.; Caldwell, R.B. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 25p. DOE Contract AC04-76DP00789. Order Number DE89011469/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report we discuss the design, fabrication and testing of three different thyristor switches. The goal of the program is to create thyristors that are more radiation hard than existing silicon based devices, by using III-V compound semiconductor fabrication technology. The thyristors were tested for dark switching, optical switching with a solid state laser, and radiation induced switching with a 3 nanosecond x-ray pulse. Two of three designs showed great promise for a radiation hardened switch; they could be easily triggered with a low power laser at voltages well below those required for switching at 3×10^9 rads/sec dose rate. 3 refs., 8 figs.

26909 (SAND–89-8231) **Department 8450 electrical overstress, EOS, and electrostatic discharge, ESD, damage control handbook.** Tockey, R.J. Sandia National Labs., Livermore, CA (USA). Apr 1989. 30p. DOE Contract AC04-76DR00789. Order Number DE89010552/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Handbook prescribes requirements and procedures to be used when electrical overstress/electrostatic discharge vulnerable product is being handled, packaged, and/or processed. All employees of department 8450 are required to: (1) observe the requirements and procedures when involved in pertinent, in-house activities, and (2) insure that vulnerable material, for which 8450 is responsible, is not exposed to possibly damaging environments when it is in the hands of others. 4 figs.

26910 Low smear CCD camera for high frame rates. Turko, B.T. (Electronics Engineering Dept., Engineering Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Yates, G.J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 165-169 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A small versatile CCD camera is described. Frame readout times from one second to milliseconds can be changed continuously or at random by a programmable clock. A very large range of light intensity is thus covered without the need for a mechanical aperture control. The camera can be reset at any time and then restarted at a different frame rate after the pause of a selected duration. Sony, Inc. ICX016AL sensor was found especially suitable for clock rates up to 50 MHz. Image smear, blooming and noise are substantially lower than in earlier interline transfer CCD sensors. Critical circuits are also described and measured data presented.

26911 Evaluation of fast voltage discriminators in the picosecond time range. Kolbe, W.F. (Lawrence Berkeley Lab., Berkeley, CA (US)); Turko, B.; Smith, C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 412-415 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

An automated system for the evaluation of fast risetime voltage discriminators is described. A high-performance time digitizer is used to determine the elapsed time between the generation of a test pulse and the response of the discriminator under test. The measurement is repeated for a series of discriminator threshold levels generated by a digital-to-analog converter and the results compared to a photograph of the leading edge of the pulse obtained with a sampling socilloscope. To obtain high accuracy, an average of several thousand individual digitizations is used in each measurement to reduce the uncertainty to a maximum of ±3 ps. The measurement system is used with a test fixture to evaluate the performance of a number of tunnel diodes and in preliminary measurements of a prototype discriminator of new design.

26912 Monolithic transceiver for FASTBUS cable segment - CSX. Walz, H.V. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA (US)); Bertolucci, B.; Gustavson, B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 532-535 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Specifications for a five-channel differential transceiver for the FASTBUS Cable Segment have been developed. The transceiver, CSX, is being planned as a full-custom integrated circuit implementation. Specification and development plans are discussed. The project is being carried out in collaboration with the NIM/FASTBUS Committee.

4209 Waste Processing Plants and Equipment

Refer also to citation(s) 26425, 26426, 26681

4210 Combustion Systems

Refer also to citation(s) 26656, 26863

26913 (AD-A–202426/3/XAB) **High-density fuel effects. Final report, September 1985-April 1988.** Rizk, N.K.; Oechsie, V.L.; Ross, P.T.; Mongia, H.C. General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Div. 18 Aug 1988. 174p. (DDA-EDR–13471). Available from NTIS, PC A08/MF A01.

The purpose of this program was to determine, by combustor rig tests and data evaluation, the effects of the high-density fuel properties on the performance and durability of the Allison T56-A-15 combustion system. Four high-density fuels in addition to baseline JP4 were evaluated in the effort. The rig-test program included: nozzle-flow bench testing, aerothermal performance and wall temperature, flame stability and ignition, injector coking and plugging, and flow-transient effect. The data-evaluation effort involved the utilization of empirical correlations in addition to analytical multidimensional tools to analyze the performance of the combustor. The modifications required to optimize the performance with high-density fuels were suggested and the expected improvement in performance was evaluated.

26914 (SC/M–C-3) **Great Lakes Forest Research Centre boiler study. Wood fired boiler feasibility study.** Sandwell and Co. Ltd., Montreal, PQ (Canada). 1978. vp. (CE–02560). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Canadian Forestry Service is considering the installation of a wood fired boiler to meet the energy requirements of the Great Lakes Research Centre at Sault Sainte Marie, Ontario. An engineering company has been retained to conduct a study of the technical feasibility and estimates of capital and operating costs of using wood based fuels. The most readily available wood based fuel in the area consists of sawmill and veneer mill wood wastes. The design heating requirements of the centre are 7.3 GJ/h; the wood waste requirement would be 2600 ton/y. With the Centre's requirement that only proven full scale equipment be considered, a review has been conducted of modern suspension burning, pile burning, and fluidized bed units. A number of manufacturers have been identified as having equipment that would be suitable for firing 8 cm minus, 50% moisture green wood waste. The possible installation of the wood fired boiler at the Centre is discussed. The preliminary capital cost of the boiler is estimated at $930,000 as compared to $65,000 for the natural gas fired alternative; the operating costs are estimated at $57,700 and $47,700 per year respectively. As the price of natural gas increases in future years, operating cost savings through the use of wood fuel could eventually materialize. However, the very substantial additional amount of capital required for a wood fired boiler system makes it unlikely that it could be justified for many years to come. 3 figs., 9 tabs.

26915 (TYOT-JULK–297) **Weak-powered feeders and burners of domestic fuels.** Tuomi, S.; Koivukangas, J.; Kouki, J. Tyotehoseuran Julkaisuja, Helsinki (Finland). Apr 1988. 103p. (In Finnish). Order Number DE88757332/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

The purpose of this research, made in the Forestry Department of the Work Efficiency Institute, was to find out the technical characteristics of small burners and feeders using domestic fuels (wood chips, peat), the suitability of different fuels for them, the requirements of burners upon boilers, the effect of the using method upon the functioning of the apparatus and the developing needs of the apparatus. The realization was divided into three parts: trials of feeding the fuel, heating trials and interviewing-observing in practice. One of the four feeding apparatus examined did not suit for automized heating, because it had no mechanism against scaffolding. The suitability of grain screws for the transport of wood chips depended on the dimensioning of the conveyor, on the rotational velocity of the screw and on the piece size of the chips. Of the five burners tested three reached the nominal output mentioned by the manufacturer, with all the fuels. It was possible to adjust the burners to part-outputs from null output up to nominal output, when a fuel of good quality was used. So the burners could be utilized for direct heating, with certain reservations. The average total efficiencies of the burner-boiler combinations were, with the nominal output of the burner, 70-80%. The distribution of combustion air was better under control and the efficiency of combustion higher in cylindrical burner heads than in heads of some other constructions. The adjustment of the burning of a burner of pre-burning chamber type succeeded best when chips that were not artificially dried were used. The other burners worked best with dry fuel. The interviewing-observation proved, that even though almost all the users of burners and feeders were satisfied with the heating system they had chosen, they still had problems.

26916 Response of a pulse combustor to changes in total ignition delay time. Keller, J.O. (Sandia National Labs., Livermore, CA (US)); Bramlette, T.T.; Westbrook, C.K.; Dec, J.E. pp. 448-453 of Combustion fundamentals and applications. Combustion Institute, Pittsburgh, PA (1987). (CONF-870541–: Combustion fundamentals and applications: spring technical meeting of the Central States Section of the Combustion Institute, Argonne, IL, US, May 11, 1987).

The response of a valved pulse combustor to changes in the relative timing between the resonant pressure wave and the energy release rate is examined. Experiments were performed in which measurements of combustion chamber pressure, operating frequency, and spatially-integrated, time-resolved ensemble-averaged <OH> chemiluminescence were made. The total time interval required for energy release is divided into a fluid dynamic species mixing time, a second fluid dynamic mixing time between cold reactants and hot reaction products, and a homogenous chemical kinetic ignition delay time. Each of these time scales is varied independently, as well as the characteristic resonance time of the pulse combustor. It is shown that each time scale can be varied separately to optimize the operation of the pulse combustor. All of these system responses are interpreted in terms of Rayleigh's Criterion. In addition, theoretical models for the fluid dynamic mixing process and the chemical kinetic ignition delays are used to determine actual values for the time scales for some of these subprocesses.

4230 Marine Engineering

Refer also to citation(s) 26758

26917 (NEI-DK–151) **Wave grouping measures.** Mansard, E.; Sand, S.E.; Klinting, P. Dansk Hydraulisk Inst., Hoersholm (Denmark). [1989]. 83p. Order Number DE88757313/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

EFP-86.

There are recent indications that distinct wave groupings can be found even in deep water. The main objective has been to give a statistical description suitable for the design of coastal and offshore structures and it is undertaken to make further investigations in this field by analyzing some prototype records using the concepts of run length of high waves and spectrum of squared elevation, the limitations and performances of which in nonlinear waves will be highlighted in this study. An attempt has been made to relate this wave grouping to the surge motion of a floating structure with a simple mooring arrangement and thereby to propose a motion-based grouping measure. It appears that the observed run length statistics can be suitably described by Kimura's predictions if the records are sufficiently long. Records whose duration are equal to, or less than, 0.6 h reflect a large statistical variability in the various wave grouping measures. The filter cut-off proposed in the concept of SIWEH for the estimation of Groupiness Factor appears to be too high to give meaningful contrasts with respect to prototype values of the peakedness factors. It is therefore proposed to use the Hilbert Transform of the time series and a cut-off which is relevant to the natural period of the test structure. In the absence of information about this natural period a cut-off $fc \leq f_p/15$ may work better. The motion equivalent groupiness factor concept could be used effectively to determine the critical sea state conditions to be used for testing of floating structures. The directional resolution of the sea state and theoretical formulations defining statistical variabilities caused by finite record lengths could be useful in evaluating whether the wave grouping is a linear process. (AB) 49 refs.

43 PARTICLE ACCELERATORS

26918 (INIS-SU–79) **Physical experiment techniques. Scientific-technical collection.** Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. 100p. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; No. 3(34).

Individual papers are indexed separately.

26919 (INIS-SU–79, pp. 69-70) **On the theory of laser acceleration over dielectric ridge grating.** Borovskij, I.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Radioastronomicheskij Inst.); Zhilkov, S.V.; Khizhnyak, N.A.; Papkovich, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Using the method of integral functionals a possibility of charged particle acceleration by a surface electromagnetic wave (SEW) field excited by a laser beam above a dielectric comb is studied. The analytical study has shown that a standing wave can exist above the dielectric comb with the efficiency of a Gauss light beam transformation into a standing close to 1. 3 refs.; 2 figs.

4301 Design, Development, and Operation

Refer also to citation(s) 26967, 27015, 27024, 27031

26920 (DOE/ER/40150–59) **Radiation control at the Continuous Electron Beam Accelerator Facility (CEBAF), a new high power CW electron accelerator installation.** Stapleton, G.B.; Thomas, R.H. Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. 1989. 7p. DOE Contract AC05-84ER40150;AC03-76SF00098. (CEBAF-PR–89-001). Order Number DE89010345/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A description is given of the design goals and radiation control measures, for a new 4 GeV, 1 MW electron accelerator under construction in the USA. The paper illustrates the importance of cooperation between designers and regulators. 15 refs., 1 fig., 3 tabs.

26921 (INIS-BR–1458, pp. 54) **Development of electrostatic accelerators.** Sala, O. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTROSTATIC ACCELERATORS/nuclear physics; ELECTROSTATIC ACCELERATORS/uses; USES

26922 (INIS-SU–79, pp. 5-7) **Low-charge heavy ion accelerator with the 6 MHz spatial uniform quadrupole focusing.** Artemov, V.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Balabin, A.I.; Batalin, V.A. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A prototype of the first section of the linac initial part with spatial uniform quadrupole focusing at 6.19 MHz for accelerating Bi^{2+} ions up to 7.5 MeV energy is disigned in ITEP. The design parameters of this section with lumped inductors, results of its start-up with Xe^{2+} ions accelerated from 130 keV to 4.6 MEv at 3.5 mA beam pulsed current are discussed. The accelerating field strength sufficient for Bi^{2+} ion acceleration is attained. 2 refs.; 1 fig.

26923 (INIS-SU–79, pp. 8-13) **Status of adjustment of the KhFTI multicharges ion linear accelerator.** Bomko, V.A.; Rudyak, B.I.; Kobets, A.F. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

All systems of multicharged ion linear accelerator designed for 8.5 MeV/nucleon energy have been assembled. The accelerated ion mass number range is from helium to argon. Practically all accelerator systems: injection system, HF power supply, control, thrmostatic, focusing, measuring systems are newly constructed. The main section is designed on the basis of a new modification of H type accelerating structure. Adjustment has been conducted at the accelerator that has been resulted in production of an accelerated He ion beam of 10^{10} particles/s intensity. Realization of the scheduled works on optimizing operating conditions of the accelerator systems will enable to bring the accelerator up to design levels of beam current and mass number range by the end of 1987. The characteristics of accelerator systems are presented and results of works on bringing accelerator systems to design mode are discussed. 10 refs.; 6 figs.; 3 tabs.

26924 (INIS-SU–79, pp. 14-20) **NIIEFA electron linear accelerators for industry and medicine.** Vakhrushin, Yu.P. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)); Glukhikh, V.A.; Nikolaev, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Resonance electron linear accelerators designed for industry and medicine constructed in NIIEFA named after D.V. Efremov are considered. In 1981-1986 accelerators for radiography, activation analysis, radiation chemistry were put into operation. Oncological clinics are still being equipped by therapeutical linear accelerators. Technical documentation for a number of new accelerators-defectoscopes and two new models of therapeutical electron linear accelerators is developed. Besides these installations new powerfull accelerators for activation analysis, radiation technology and production of short-lived isotopes are being developed. 12 refs.; 2 figs.; 3 tabs.

26925 (INIS-SU–79, pp. 27-29) **Topics relating to exploitation and research of a HF quadrupole focusing accelerator.** Zenin, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Some features of a HF quadrupole focusing accelerator are described. The methods of measurement of characteristics of the accelerating channel using injection of collimated particle beams, as well as the method of control of beam losses based on measurement of the secondary radiation intensity distribution along the accelerator are presented. The method of control of electrical strength of accelerating gaps and state of electrode surface are described. The experimental results on breakdowns in cavity resonators and reliability of injector operation in the IHEP booster are given. 7 refs.; 3 figs.

26926 Development of new scintillating fiber detectors for high energy physics applications. Ruchti, R. (Dept. of Physics, Univ. of Notre Dame, Notre Dame, IN (US)); Baumbaugh, B.; Bose, A.; Ditmire, T.; Kennedy, C.; Puseljic, D.; Baumbaugh, A.; Knickerbocker, K.; Ellis, J.; Mead, R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 146-149 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

The authors have been developing new scintillating fiber detectors for colliding beam and fixed target applications. In this paper, they present initial results from a developmental study of high refractive index, liquid scintillators, and the incorporation of these liquids into glass capillaries. Advantages of liquid-in-capillary fiber detectors include: high efficiency and fast decay; the potential for high-resolution tracking as light emission is expected to be local to the deposited ionization in liquids containing single solutes; the potential for good radiation resistance; and replaceability.

26927 Progress report on Cerenkov ring imaging detector development. Aston, D. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA (US)); Bienz, T.; Bird, F.; Dasu, S.; Dunwoodie, W.; Hallewell, G.; Kawahara, H.; Solodov, E.; Bean, A.; Caldwell, D. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 276-281 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

The authors present recent progress on the construction and testing of the first drift boxes and single electron detectors as they come from the production line. These detectors will be used for particle identification using the Ring Imaging technique in the SLD experiment at SLAC. Various experimental results are presented, including single electron pulse height measurements as a function of gas gain, detector gating capability, uniformity of response across the wire plane, charge division performance of a single electron signal, average pulse shape and its comparison with predicted shape, and cross-talk.

26928 A fastbus flash ADC system for the Mark II Vertex chamber. Barker, L. (Stanford Linear Accelerator Center Stanford Univ., Stanford, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 643-645 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

This is a description of a flash ADC system built for the Mark II experimental at the Stanford Linear Accelerator Center (SLAC). This system was designed for use in the experiment's vertex chamber where signals could occur over a relatively long time, approximately 10 microseconds. This long time, coupled with fast cable amplifiers, necessitated an alternate design approach than was used with a dE/dX FASTBUS flash ADC design.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 26964

26929 (FNAL/C–89/64) **Flying wires at Fermilab.** Gannon, J.; Crawford, C.; Finley, D.; Flora, R.; Groves, T.; MacPherson, M. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 4p. DOE Contract AC02-76CH03000. (CONF-890335–74: 13. particle accelerator conference, Chicago, IL, US, March 20, 1989). Order Number DE89011005/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Transverse beam profile measurement systems called "Flying Wires" have been installed and made operational in the Fermilab Main Ring and Tevatron accelerators. These devices are used routinely to measure the emittance of both protons and antiprotons throughout the fill process, and for emittance growth measurements during stores. In the Tevatron, the individual transverse profiles of six proton and six antiproton bunches are obtained simultaneously, with a single pass of the wire through the beam. Essential features of the hardware, software, and system operation are explained in the rest of the paper. 3 refs., 4 figs.

26930 (FNAL-TM–1559) **Accelerating polarized beams in Tevatron.** Teng, L.C. Fermi National Accelerator Lab., Batavia, IL (USA). Feb 1989. 27p. DOE Contract AC02-76CH03000. Order Number DE89011470/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we will examine the totality of equipment, manpower and cost necessary to obtain a polarized proton beam in the Tevatron. We will not, however, be concerned with the acquisition and acceleration of polarized $\vec{p}X$ beams. Furthermore we will consider only a planar main ring without overpass, although it is expected that Siberian snake schemes could be made to apply equally well to non-planar machines. In addition to not wanting to tackle here the task of reformulating the theory for a non-planar closed orbit, we also anticipate that as part of the Tevatron upgrade the main ring will in the not too distant future, be replaced by a planar main injector situated in a separate tunnel. 4 refs., 11 figs., 1 tab.

26931 (INIS-BR–1458, pp. 84) **Energy monitor for electron accelerators.** Geske, G. (Jena Univ. (German Democratic Republic)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ACCELERATORS/electron beams; ACCELERATORS/monitors; MONITORS/accelerators; MONITORS/specifications; ACCELERATORS; MONITORS; MEV RANGE 01-10; MEV RANGE 10-100; SPECIFICATIONS

26932 (INIS-BR–1458, pp. 180) **Traits of electron dose distributions of Chinese Linear Accelerator.** Tao, J. (Academia Sinica, Wulumuqui (China). Xinjiang Inst. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON BEAMS/depth dose distributions; ELECTRON BEAMS/linear accelerators; ELECTRON BEAMS/polystyrene; CHINA; POLYSTYRENE; EXTRAPOLATION CHAMBERS; MEV RANGE 01-10

26933 (INIS-BR–1458 IV.28) **Traits of electron dose distributions of Chinese accelerator.** Tao, J. (Academia Sinica, Urumqui (China). Xinjiang Inst. of Physics); Mi, W.; Yi, L. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON BEAMS/depth dose distributions; ELECTRON BEAMS/linear accelerators; CHINA; EXTRAPOLATION CHAMBERS; MEV RANGE 01-10

26934 (INIS-SU–79, pp. 24-26) **Stability of motion of high-current ion beams in strong-focusing channels.** Korostelev, A.N.; Repalov, N.S.; Khizhnyak, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

For the case of approximation of accelerating and focusing fields in a linear accelerator by a square wave a focusing period matrix permitting to take into account the strength of bunch space charge is derived. Stability diagrams plotted using this matrix for low and high beam currents are presented. Evolution of a bunch in the form of ellipsoid passing through the focusing channels with different ridgidity corresponding to the characteristic points on the stability diagram. Focusing conditions for some types of focusing channels are presented. 6 refs.; 5 figs.

26935 (INIS-SU–79, pp. 30-32) **Experimental research of beam dynamics and technique of optimal tuning of the I-2 proton accelerator.** Romanovskij, R.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Stolbunov, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The method and results of optimization of operating conditions of the I-2 linear accelerators - injector of the U-10 proton synchrotron are described. The experiments were carried out using an on-line measurement system of instant energy spectra of accelerated particles on-line with ES-1010 computer. The typical dependences permitting to choose accelerator operating conditions for determining the necessary beam energetic parameters: maximum current pulse, present energy spectrum width, stable average pulse are given. 5 refs.; 5 figs.

26936 (INIS-SU–79, pp. 33-34) **Application of passive resonators for the beam parameter control in linear resonance accelerators.** Vishnyakov, V.A.; Kushnir, V.A.; Romas'ko, V.P.; Shenderovich, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The results of experiments on generation of high accelerating fields while exciting electrons in passive resonators by a linear accelerator beam are presented. Using accelerating fields for energy control and stability accelerator beam parameters is considered. At pulse beam current of 400 mA and bunch phase length of 40deg in the resonators tuned for the second harmonic of bunch repetition frequency an electric field with 400 kV/cm strength is generated. This field can be used either for decreasing and controlling particle

energy or subacceleration of a part of the beam. A chain of 7 passive resonators at 200 mA has enabled to obtain a particle energy gain of 2.2 MeV. 2 refs.; 2 figs.

26937 (INIS-SU–79, pp. 37-39) **Behaviour of envelopes of intense beams in accelerating-focusing channels.** Danilov, V.D. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)); Zobov, M.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The behaviour of envelops accelerating-focusing channels is considered. It is shown that an average beam size in the transverse direction is a sum of periodical functions with three frequencies. That is why resonances of envelope oscillations with focusing element replication frequency in the channel are possible. It is noted that the choice of parameters of the beam and accelerating channel can influence sensitivity to beam mismatching in a four-dimensional transverse phase space due to slight mismatching in a longitudinal phase space. 3 refs.; 1 fig.

26938 (LA-UR–89-1230) **Cherenkov wakefield accelerators: Rippled waveguides.** Jones, M.E.; Keinigs, R.K.; Peter, W.; Wilks, S.C. Los Alamos National Lab., NM (USA). 1989. 13p. DOE Contract W-7405-ENG-36. (CONF-890197–8: Advanced accelerator concepts workshop, Lake Arrowhead, CA, US, January 9, 1989). Order Number DE89011185/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The properties of using periodically rippled waveguides as wakefield accelerators are investigated. An analysis is performed in the ultrarelativistic limit which accurately predicts the amplitude, wavelength of the wakefield, and their dependences on waveguide and drive beam parameters. These devices are found to have the properties that the synchronous transverse wake vanishes, and the accelerating field is independent of the radial position in the drift tube and independent of the radial profile of the drive beam current. The effects of the nonsynchronous wakefields are discussed. Also, particle-in-cell simulations are performed which agree with the analysis and reveal self-consistent and collective effects in particle acceleration. 20 refs., 2 figs.

26939 Orbit-reversing magnets for the National Bureau of Standards-Los Alamos racetrack microtron. Wilson, M.A. (Radiation Source and Instruments Div., National Bureau of Standards, Gaithersburg, MD (US)); Debenham, P.H.; Penner, S.; Bruce, S.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 1306-1310 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

In the National Bureau of Standards (NBS)-Los Alamos racetrack microtron (RTM), the 17-MeV electron beam that has made one pass through the RTM linac is deflected 180^0 in one end magnet and is returned to the same end of the (standing wave) linac for a second pass. A pair of dipole magnets on the linac axis compensate for the beam displacement caused by the end magnet so that the beam enters the linac on axis. These two magnets are designed to have equal field integrals in order to produce a pure displacement. Matching the field integrals was complicated by the quite different widths of the two magnets that have different beam clearance requirements. In addition the wider magnet contains a quadrupole coil for beam steering. Design considerations are presented. Magnetic field measurements show that critical design goals have been achieved.

4303 Auxiliaries and Components

Refer also to citation(s) 26929, 26938, 26939

26940 (BNL–41464) **Vacuum chamber eddy current correction coil for the AGS Booster.** Danby, G.; Jackson, J. Brookhaven National Lab., Upton, NY (USA). 1988. 3p. DOE Contract AC02-76CH00016. (CONF-880695–71: 1. European particle accelerator conference (EPAC-1), Rome, IT, June 7, 1988). Order Number DE89011250/JAW. Available from NTIS, PC A02 - OSTI.

The AGS Booster injector will perform a variety of functions. Heavy ion acceleration requires a bakeable, ultra-high vacuum system (VC). Acceleration for intense proton beams requires rapid cycling ($B \prec 10T/sec$). If straight forward heavy walled VC are used, the field perturbations due to eddy currents are large. The state of the art lattice has highly distributed lumped sextupoles capable of substantially correcting the induced field nonlinearity. Nevertheless, for the very highest space charge-intensity limits, it is desirable to have the capability to remove eddy current fields at the source. Correction coils attached to the outside of the VC cancel its current aberrations over the required good field aperture. These can be passively powered by transformer action, using two turn windings around the magnet yoke. Programmed power supplies can also be used. This inexpensive additional correction option uses a three turn per quadrant coil which follows the local contour of the VC. Transverse movements of several mms of the VC will have no beam optical effect since the large field aberrations and their corrections have the same displaced coordinates. Experimental and computer studies will be presented, as well as mechanical and electrical design of a simple method of construction. 6 figs.

26941 (FNAL/C–89/53) **SSC [Superconducting Super Collider] dipole coil production tooling.** Carson, J.A.; Barczak, E.J.; Bossert, R.C.; Brandt, J.S.; Smith, G.A. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 10p. DOE Contract AC02-76CH03000. (CONF-890270–3: International industrial symposium on the super collider, New Orleans, LA, US, February 8, 1989). Order Number DE89011006/JAW. Available from NTIS, PC A02 - OSTI.

Superconducting Super Collider dipole coils must be produced to high precision to ensure uniform prestress and even conductor distribution within the collared coil assembly. Tooling is being prepared at Fermilab for the production of high precision 1M and 16.6M SSC dipole coils suitable for mass production. The design and construction methods builds on the Tevatron tooling and production experience. Details of the design and construction methods and measured coil uniformity of 1M coils will be presented. 4 refs., 10 figs.

26942 (FNAL/C–89/55) **Coil measurement data acquisition and curing press control system for SSC dipole magnet coils.** Dickey, C.E. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 16p. DOE Contract AC02-76CH03000. (CONF-890270–5: International industrial symposium on the super collider, New Orleans, LA, US, February 8, 1989). Order Number DE89011101/JAW. Available from NTIS, PC A03 - OSTI.

A coil matching program, similar in theory to the methods used to match Tevatron coils, is being developed at Fermilab. Modulus of elasticity and absolute coil size will be determined at 18-inch intervals along the coils while in the coil curing press immediately following the curing process. A data acquisition system is under construction to automatically acquire and manage the large quantities of data that result. Data files will be transferred to Fermilab's VAX Cluster for long-term storage and actual coil matching. The data acquisition system will also provide the control algorithm for the curing press hydraulic system. A description of the SSC Curing Press Data Acquisition and Controls System will be reported. 20 figs.

26943 (FNAL/C–89/72) **A magnetically switched kicker for proton extraction.** Dinkel, J.; Biggs, J. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 4p. DOE Contract AC02-76CH03000. (CONF-890335–75: 13. particle accelerator conference, Chicago, IL, US, March 20, 1989). Order Number DE89011091/JAW. Available from NTIS, PC A02 - OSTI.

The application of magnetic current amplification and switching techniques to the generation of precise high current pulses for switching magnets is described. The square loop characteristic of Metglas tape wound cores at high excitation levels provides excellent switching characteristics for microsecond pulses. The rugged and passive nature of this type pulser makes it possible to locate the final stages of amplification at the load for maximum efficiency. 12 refs., 8 figs.

26944 (FNAL-TM-1561) **The design, fabrication, operation and maintenance of (41) 400 H.P.-600 SCFM helium screw compressor systems (Five-year operation report).** Pallaver, C. Fermi National Accelerator Lab., Batavia, IL (USA). Dec 1988. 30p. DOE Contract AC02-76CH03000. Order Number DE89011474/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fermi National Accelerator Laboratory (Fermilab) uses thirty-four (34) identical compressor systems connected to a common header to supply clean high pressure helium gas feeding 26 refrigerators supplying liquid helium to 777 super conducting magnets. There are seven (7) similar compressor packages in other locations. The purpose of this paper is (after five years of operation) to present all the problems, modifications and experiences associated with the design and operation of these compressor systems.

26945 (FNAL-TM-1566) **Argon and argon-oxygen glow discharge cleaning of the Main Ring beam pipe.** Trbojevic, D.; Pastore, N. Fermi National Accelerator Lab., Batavia, IL (USA). 15 Feb 1989. 9p. DOE Contract AC02-76CH03000. Order Number DE89011491/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report presents the experimental results from the argon and argon-oxygen gas mixture glow discharge in the Main Ring beam pipe and is a follow-up to the proposal for vacuum improvements of the Main Ring magnets and straight sections and the warm Tevatron straight sections. Glow discharge was used in the experiment in order to clean the vacuum system instead of bakeout which could only be performed with great difficulty or not at all. It is a relatively simple and very effective method. The glow discharge occurs under specific gas pressures (10–120 mTorr) and current flows (10^{-5} – 10^{-1} A) through gas excitation and formation of plasma conditions. Deexcitation of the gas molecules produces visible light. Several mechanisms have been proposed to explain the glow discharge cleaning process. Ions can sputter adsorbed molecules or atoms at the cathode surface and even produce lattice damage extending several monolayers below the surface. The glow discharge has already been extensively used for vacuum improvements in accelerators. 9 refs.

26946 (FNAL-TM-1580) **Status of suspension connection for SSC [Superconducting Super Collider] assembly.** Larson, E.T.; Nicol, T.H.; Niemann, R.C.; Zink, R.A. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 10p. DOE Contract AC02-76CH03000. (CONF-890270–9: International industrial symposium on the super collider, New Orleans, LA, US, February 8, 1989). Order Number DE89011479/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Superconducting Super Collider dipole magnets require an integrated suspension system to meet the structural and thermal requirements outlined in the design criteria. Sliding suspension connections which retain the cold mass assembly during static and dynamic loading, while allowing axial motion during thermal contraction are an integral part of this magnet suspension system. Variations from the original prototype design have been tested and their performance compared. The results of these evaluations, and areas of future investigation are described. 7 refs., 7 figs., 1 tab.

26947 (FNAL-TM-1581) **Model SSC [Superconducting Super Collider] dipole magnet cryostat assembly at Fermilab.** Niemann, R.C. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 12p. DOE Contract AC02-76CH03000. (CONF-890270–8: International industrial symposium on the super collider, New Orleans, LA, US, February 8, 1989). Order Number DE89011478/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Superconducting Super Collider (SSC) magnet development program includes the design, fabrication and testing of full length model dipole magnets. A result of the program has been the development of a magnet cryostat design. The cryostat subsystems consist of cold mass connection-slide, suspension, thermal shields, insulation, vacuum vessel and interconnections. Design details are presented along with model magnet production experience. 6 refs., 13 figs.

26948 (FNAL-TM-1582) **SSC [Superconducting Super Collider] magnet mechanical interconnections.** Bossert, R.C.; Niemann, R.C.; Carson, J.A.; Ramstein, W.L.; Reynolds, M.P.; Engler, N.H. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 13p. DOE Contract AC02-76CH03000. (CONF-890270–7: International industrial symposium on the super collider, New Orleans, LA, US, February 8, 1989). Order Number DE89011477/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Installation of superconducting accelerator dipole and quadrupole magnets and spool pieces in the SSC tunnel requires the interconnection of the cryostats. The connections are both of an electrical and mechanical nature. The details of the mechanical connections are presented. The connections include piping, thermal shields and insulation. There are seven piping systems to be connected. These systems must carry cryogenic fluids at various pressures or maintain vacuum and must be consistently leak tight. The interconnection region must be able to expand and contract as magnets change in length while cooling and warming. The heat leak characteristics of the interconnection region must be comparable to that of the body of the magnet. Rapid assembly and disassembly is required. The magnet cryostat development program is discussed. Results of quality control testing are reported. Results of making full scale interconnections under magnet test situations are reviewed. 11 figs., 4 tabs.

26949 (INIS-BR-1458, pp. 88) **Accurate analytic off-axis trajectories of relativistic electrons in realistic 2D transverse wigglers with arbitrary magnetic field variation.** Torggler, P. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik); Leubner, C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRONS/magnetic field configurations; ELECTRONS/trajectories; ELECTRONS/wiggler magnets; ACCURACY; ANALYTICAL SOLUTION; ELECTRONS; TRAJECTORIES; RELATIVISTIC RANGE; SYNCHROTRON RADIATION SOURCES; TWO-DIMENSIONAL CALCULATIONS

26950 (INIS-SU-73, pp. 55-56) **Application of measuring technique for diagnostics of electrodynamic characteristics of accelerating structures by synchronous acceleration of electron beam.** Kozlyuk, V.V. (AN SSSR, Novosibirsk. Inst. Khimicheskoj Kinetiki i Goreniya); Perov, V.V. Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1988. (In Russian). In *Physical experiment engineering. Scientific-technical collection.* Order Number DE89780082/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(36).

Physical foundation of the method for determinating parameters of accelerating structures based on probing by an electron beam and the results of measurement of the characteristics of inhomogeneous accelerating structures in the region with high and average slowing-downs are presented. The direct method for measuring characteristics of accelerating structures with synchronous acceleration of an electron beam, which can be applied to investigate the structures of both a constant and a variable step, is developed. The method error can reach 0.5...1 %. Limitations of method applicability are shown. A measuring stand realizing this method is described. The results of measurement of characteristics of an oncoming-bar quasiperiodic structure are presented, and comparison with the results of measurements by cold methods is carried out. 2 refs.; 2 figs.

26951 (INIS-SU-79, pp. 40-42) **Experimental definition of relative losses of high-frequency power in complex shape resonator elements.** Belyaev, O.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Stepanov, V.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number

DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Experimental determination of distribution of losses in resonator elements by measuring its quality factor at different surface resistances of an element of interest is discribed. The measuring technique for an unknown surfce resistance is considered. The dependence of losses on flanges of the 2N resonator on the face area is determined. The errors of obtained results are analyzed. 14 refs.; 3 figs.; 1 tab.

26952 (INIS-SU–79, pp. 58-59) **On-line control system for electron injector based on autoemission cathode.** Egorov, N.V. (Leningradskij Gosudarstvennyj Univ. (USSR)); Karpov, A.G.; Ovsyannikov, D.A.; Prudnikov, A.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

An original on-line system of control of electron injector parameters on the base of an autoemission cathode is described. The system includes hardware (analog-to-digital and graphical displays, a printer, a magnetic disc memory a plotter) and data control and readout equipment. A high-voltage power source of the 'RACE' is controlled by digital measuring devices connected with a computer data via a special matching device. Software includes servicing subroutines for injector controls and those permitting to display, plot and print results. The main operating program functioning in the interactive mode enables to specify the injector operating conditions and check its characteristics. 2 refs.; 1 fig.

26953 (INIS-SU–79, pp. 76-78) **Study on the ion-optical characteristics of the injector with RF ion source for small-dimensional electrostatic accelerator.** Simonenko, A.V.; Zats, A.V.; Levchenko, Yu.Z.; Bogdalin, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The effect of electric potential of a small-sized electrostatic accelerator injector electrodes on ion beam shaping is studied. For studying the beam behaviour in the region of extracting and accelerating electrodes the electric potential distribution was found using numerical solution of the Laplace equation in the region under consideration. After that using the obtained data particle trajectories are numerically calculated. Relocation of an imaginary crossover with electric potential variation of the given electrodes can considerably affect beam focusing at the electrostatic accelerator output. 5 refs.; 5 figs.

26954 (INIS-SU–79, pp. 56-57) **Calculation of geometry of powerfull absorption loading for meter wave generator.** Kislyj, O.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Mazurov, E.V.; Mal'tsev, I.G.; Nagaev, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The method for calculating geometry of cooled coaxial loads with complex inhomogeneous filling is considered. The law of variation of external conductor diameter providing for a high degree of loading matching with a coaxial feeder is proposed. Calculation and result of model tests of loads on the basis of UV1-50-51 commercial resistor with water cooling at 148.5MHz frequency are given as an example. Calculations were carried out on the basis of the theory of long lines taking into account construction reactivity at the load output and real characteristic of the distribution of length resistor resistance. During experimental study of the load mock-up in the frequency range from 50 to 240 MHz the calculated standing wave ratio did not exceed 1.05 with the measurement accuracy of the R4-11 device. 5 refs.; 1 fig.

26955 (INIS-SU–79, pp. 61-62) **Capacitor storage voltage stabilization device.** Logvin, V.V.; Gusev, E.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

An electric circuit of a device designed for charging and stabilizing a capacitor storage is described. A phase-pulse method for thyristor control in the power transformer first circuit is used. In the process of storage charging the triggering angle of thyristors linearly grows, that excludes the necessity of application of current-limiting elements in the charging circuit. The averaged charging voltage of the storage linearly dependce on charging time. Charging is realized by a series of short-time current pulses. Output voltage is controlled within 10...95% limits of the rated value. Voltage instability is $\leq$0.5% at power supply voltage variation of $\pm$10%. 1 ref.; 2 figs.

26956 (INIS-SU–79, pp. 63-64) **Program-controlled voltage and current generator.** Azarov, A.S. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)); Ivanov, V.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A two-channel voltage and current generator program-controlled by the 'Elektronika D3-28' microcomputer on the basis of the KR 580 microprocessor unit and ten-bit digital-to-analog converters is described. The output voltage variation range is 0...10,24V, current variation range is 0...1A, output signal step number is 1024, a possibility to change output signal polarity by a microcomputer command is provided. The device is used in training of powerful klystrons and enables to reduce the training time. 3 refs.; 1 fig.

26957 (INIS-SU–79, pp. 73-75) **Thermal control system for a racetrack microtron of continuous action in Nuclear Physics Scientific-Research Institute of Moscow University.** Ishkhanov, B.S. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Kurbatov, A.F.; Shvedunov, V.I. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A racetrack microtron (RM) of continuous action being under construction in the Nuclear Physics Scientific-Research Institute of the Moscow University will produce 100 MeV electron beam at the output with 100 μA mean current providing for electron beam energy spread at the 10^{-3}-10^{-4} level. To ensure RM functioning with the given parameters it is necessary to design an automatic eigenfrequency control system of its accelerating structures. It can be

realized using mechanical or thermal automatic control systems. An automatic eigenfrequency thermal control system of the linear accelerator accelerating section is developed. The eigenfrequency of each section must be controlled by independent temperature variation and cooling wave flow rate. The main difference between the given thermal control system and the standard ones consists in the fact that actuators (electric heaters and flow governors) are controlled directly by signals of the field phase difference in the section and incident wave rather than by signals of the temperature conditions of the cooling wave or separate section points. Operation of this thermal control system was tested using the rig with a real linear accelerator section at a high HF power level and it demonstrated its efficiency. 4 refs.; 2 figs.

26958 (INIS-SU–79, pp. 85-87) **Using computer simultion methods for optimization of the Krit cryogenic thermocompressor performance.** Vorob'eva, V.P. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Kantsedal, V.P.; Lyubarskij, G.Ya.; Khazhmuradov, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

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From the point of view of optimal efficiency of operation of a cryogenic thermocompressor which permits to obtain high pressures at limiting number of sections. The algorithm is suggested. The analytical dependence of pressure on density which is extrapolated for the region of high-density. 5 refs.; 3 tabs.

26959 (INIS-SU–79, pp. 35-36) **Experimental research of the accelerated beam particle distribution in the Fakel electron linear accelerator in longitudinal phase space.** Kalashnikov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Moiseev, V.I.; Petrenko, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

An experimental method permitting to separate particles from narrow arbitrariliy chosen bands of a two-dimensional distribution in a longitudinal phase space and so determine the structure of two-dimensional distribution function is considered. The results of experimental research of the beam in the Fakel electron linear accelerator are presented. 1 ref.; 3 figs.

26960 (INIS-SU–79, pp. 43-45) **Phase spectra analyzer with transverse modulation of secondary low-energy electrons.** Stepanov, A.A. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Feshchenko, A.V.; Chursin, A.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A phase spectra analyzer for an accelerator of the meson factory at the IYal of the USSR Academy of Sciences is designed and manufactured. The principle of operation of analyzer is based on transverse modulation of secondary low-energy electrons knocked out by an analyzed beam from a thin target. The factors affected phase resolution are analyzed. The following main parameters: phase resolution better than 1deg (f198.2MHz), consumed HF power of 3W, minimum current of analyzed beam not greater than 10^{-6}a, are determined. 3 refs.; 4 figs.; 1 tab.

26961 (INIS-SU–79, pp. 46-48) **Ion average velocity measurer in an alternating-phase focusing linear accelerator.** Demchenko, P.A.; Koval', A.G.; Mitrochenko, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Equipment for measuring a bunched proton beam velocity at an alternating-phase focusing linear accelerator output by phase-of-flight method, permitting to realize real-time non-destructive testing of particle energy on-line with the CM-4 computer, is described. It comprises two cylindrical resonators located in the beam drift space and a phase difference measurer for pulsed radio signals excited in them with a digital count accuracy of 1deg order and minimum measuring time of 4 μs. 4 refs.; 1 fig.

26962 (INIS-SU–79, pp. 49-51) **Application of radiative acoustic effect to the beam guiding in accelerator.** Vladimirov, Yu.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Kostenets, Yu.V.; Makhnenko, L.A. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A beam transport technique for an electron linear accelerator according to information from transducers of acoustic signals excited in beam guide elements by relativistic electron beam is described. An electronic circuit for determining the place of beam impinge at the moment between an accelerator synchropulse and a moment of detection of an acoustic signal is proposed. An accuracy of determination of a beam impinge coordination is $\pm$10mm, maximum distance from the transducer and generation spot in 4 m. Transducers made of piezoceramics TsTS19, 5mm in diameter and 0.78mm thickness are used as acoustic receivers. The electronic circuit of beam localization is based on the start-stop method for measuring time interval. The digital output permits to easly match the computer-controlled circuit, and when using the system transducers and corresponding software - to realize automatic beam guiding in a linear accelerator. 1 ref.; 3 figs.

26963 (INIS-SU–79, pp. 60) **Realization of two-directional connection between microprocessor systems in on-line control system of accelerators by single optical fiber.** Vlasov, V.G. (Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The diagram of an optical transceiver for communication between computers or microcomputers via a single optical cable is given. The module operates in the transmission or receiption mode governed by an initialization program. The data exchange rate attains 9600 bands. An infrared light diode AL 107 A, which in the receiption mode plays the role of a photoreceiver, is used as an emitter. The developed circuit is used in the data acquisition and processing system, as well as in the high-current accelerator on-line control system. 1 ref.; 1 fig.

26964 (LA-UR–89-1159) **Beam dynamics calculations for the LAMPF optically pumped ion source.** Hayden, R.J.; Jakobson, M.J.; van Dyck, O.B.; York, R.L. Los Alamos National Lab., NM (USA). 1989. 4p. DOE Contract W-7405-ENG-36. (CONF-890335–90: 13. particle accelerator conference, Chicago, IL, US, March 20, 1989). Order Number DE89011198/JAW. Available from NTIS, PC A02 - OSTI.

The space charge code SCHAR has been used to interpret some of the measurements made with the LAMPF ECR source. Calculations were made for rectangular hole, single hole and multihole electrodes. Measured rotation of the plane of the ribbon beam in the constant solenoid field showed that when the polarizer cell was not utilized the beam was essentially not neutralized after it emerged from the extraction electrodes. There is evidence that when the polarizer cell is "turned on" the beam becomes neutralized from the polarizer back toward the electrode structure. The total measured current from single and multihole electrodes with the polarizer cell "on" is proportional to the area of the electrode apertures. Beam simulation calculations indicate that if the beam extracted from the source is uniform across the multihole structure, then in order for the perimeter holes to provide as much current per area, the beam would have to be at least partially neutralized after existing from the electrode structure. POISSON calculated fields were used for the single and multihole electrode fields. For a ribbon beam the field used was that of a very long slit. The initial transverse velocity and energy of the beam at the entrance to the three electrodes were adjusted to provide agreement with the measured harp histograms. The energy of the ions leaving the (unmodeled) ECR plasma determines the current for a given electrode structure and voltage. Initial transverse velocity was not a sensitive parameter. Electrode radial fields and beam space charge forces generate most of the transverse velocities observed as the beam exits from the electrodes. "Tails" which were present in the measured harp data could be explained by an H_2^+ component in the beam. 3 refs., 6 figs.

26965 (LA-UR–89-1406) **Beam position monitor upgrade for the Los Alamos Proton Storage Ring.** Shafer, R.E.; Swain, G.; Thiessen, H.A.; Macek, R.; Mackenzie, G.; Rawnsley, W. Los Alamos National Lab., NM (USA). 1989. 4p. DOE Contract W-7405-ENG-36. (CONF-890335–89: 13. particle accelerator conference, Chicago, IL, US, March 20, 1989). Order Number DE89011169/JAW. Available from NTIS, PC A02 - OSTI.

The beam diagnostics for the Los Alamos Proton Storage Ring (PSR) are being upgraded in several areas, including the closed-orbit beam position system, the high-frequency longitudinal and transverse beam diagnostics, and the extraction-line beam-position monitoring system. This paper describes the basic design of these new systems. 4 refs., 3 figs.

26966 **Precision alignment device.** Jones, N.E. To Dept. of Energy. USA Patent Application 7-166,582. 10 Mar 1988. 22p. DOE Contract W-7405-ENG-36. Order Number DE89010814/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Apparatus for providing automatic alignment of beam devices having an associated structure for directing, collimating, focusing, reflecting, or otherwise modifying the main beam. A reference laser is attached to the structure enclosing the main beam producing apparatus and produces a reference beam substantially parallel to the main beam. Detector modules containing optical switching devices and optical detectors are positioned in the path of the reference beam and are effective to produce an electrical output indicative of the alignment of the main beam. This electrical output drives servomotor operated adjustment screws to adjust the position of elements of the structure associated with the main beam to maintain alignment of the main beam. 5 figs.

26967 **A differential absorption spectrometer for determining flash X-ray spectra from 10 to 2000 keV.** Carlson, G.A. (Sandia National Labs., Albuquerque, NM (US)); Lorence, L.J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1255-1259 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

A differential absorption spectrometer has been developed and used on various bremsstrahlung sources (Pelletron, Saturn, and SPEED) with endpoint energies from 150 to 2000 keV. Spectral data were unfolded using response functions generated by TIGER and CEPXS/ONETRAN. Unfolded spectra are qualitatively in agreement with predicted spectra for steady-state bremsstrahlung sources from 150 keV to 900 keV. Applications and limitations of the diagnostic are discussed and modifications and simplifications suggested.

4304 Storage Rings

26968 (INIS-SU–79, pp. 65-68) **Spin precessor.** Grigor'ev, Yu.N.; Dementij, S.V.; Zvonareva, O.D. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

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The diagram and calculations of spin precessor, permitting to change direction of the polarized electron beam spin is proposed. The device enables to operate in a wide beam energy range from 0.6 to 3 GeV and consists of two solenoids and several dipole magnets. Realization of the given precessor circuit in the output channel of the 3 GeV electron beam storage-stretcher is assumed. 6 refs.; 3 figs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 26307, 26312, 26401, 26454, 26785, 26926, 27033, 27142, 27389, 27549, 27591, 27617, 27633, 27663, 27683, 27706

26969 (BLG–606) **Calibration of four neutron coincidence collars for PWR fresh fuel assemblies.** De Baere, P.; Carchon, R.; Smaers, G.; Smith, B.G.R.; Cranston, R.; Levy-Gorget, J.L.; Zarucki, R. Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). May 1988. 44p. Order Number DE89610904/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A measurement campaign was set up in order to calibrate four Neutron Coincidence Collars. For this purpose, a PWR fuel mock-up was used, as well as a series of real size PWR fuel assemblies. Calibration functions were set up, representing net real coincidence rate as a function of mass loading. All these calibration expressions have been referred to a general calibration expression, by applying some correction factors on the real coincidence count rate.

26970 (CONF-8905107–1) **Laser diffraction methods for high temperature strain measurements.** Pih, H.; Liu, K.C. Oak Ridge National Lab., TN (USA). 1989. 7p. DOE Contract AC05-84OR21400. From SEM spring meeting; Cambridge, MA, US; May 28, 1989. Order Number DE89008235/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Optical methods, utilizing the interference fringes produced by diffraction of laser light passing through a narrow slit, have been developed for strain measurements at high temperature above 1000°C. Basic principles, instrumentation, calibration, and measurement techniques of the methods and sample applications are presented. 3 refs., 11 figs.

26971 (EGG-M–88171) **Pulser injection with subsequent removal: implementation and applications.** Hartwell, J.K.; Goodwin, S.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 5p. DOE Contract AC07-76ID01570. (CONF-881103–60: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988). Order Number DE89010974/JAW. Available from NTIS, PC A02 - OSTI.

Electronic pulser injection has found wide application in Ge detector gamma-ray spectrometry for dead time and pulse pileup loss correction and for calculation or stabilization of the system gain and zero. However, in the standard implementation, careful attention is required to position the pulser peak(s) in an uncluttered spectral region. This is especially difficult when dual amplitude pulser injection

is used and limits this application to sources in which the spectrum is known or can be previously measured. Additionally, the elevated continuum encountered at low energies in high count-rate spectra can obliterate the pulser peak from a low amplitude pulser when a moderate injection rate is used. In our laboratory we use a technique of pulser injection with subsequent removal from the gamma-ray spectrum that provides the benefits of pulser injection without the requirement for prior spectral definition. The technique is functionally similar to the "leaky discriminators" method in its storage of pulser events in regions of the gamma-ray spectrum forbidden to gamma-ray events; however, the INEL technique uses digital logic in a special pulser control and separation module to modify (or not modify) ADC addresses based on pulser-tagging logic signals. This technique allows truly automatic and even unattended gamma-ray spectrometry. 12 refs., 7 figs.

26972 (FNAL/C–89/25-E) **Precision charge amplification and digitization system for a scintillating and lead glass array.** Delchamps, S.W.; Rameika, R.; Arenton, M.; Chen, T.Y.; Conetti, S.; Cox, B.; Etemadi, B.; Fortney, L.; Guffey, K.; Haire, M. Fermi National Accelerator Lab., Batavia, IL (USA). Jan 1989. 7p. DOE Contract AC02-76CH03000. (CONF-890297–1: IEEE nuclear science symposium, Orlando, FL, US, February 8, 1989). Order Number DE89011007/JAW. Available from NTIS, PC A- OSTI.

A 544-channel low-noise, high-rate, precision charge amplification and ADC system was constructed for the Fermilab Experiment 705 electromagnetic calorimeter, which employs SCG1-C scintillating glass and SF5 lead glass instrumented with photo-multiplier tubes. A general discussion of the system is given, and the charge amplification, fast trigger pulse generation, and analog to digital conversion aspects of the system are presented in more detail. Performance is evaluated using data from Experiment 705 and from off-line tests. Short and long term pedestal stability, baseline recovery and rate capability, linearity of response, and crosstalk between channels are discussed. 8 refs., 2 tabs.

26973 (FNAL-TM–1573) **Performance of a lead radiator, gas tube calorimeter.** Spiegel, L.; Arenton, M.; Chen, T.Y.; Conetti, S.; Cox, B.; Delchamps, S.W.; Etemadi, B.; Fortney, L.; Guffey, K.; Haire, M. Fermi National Accelerator Lab., Batavia, IL (USA). 13 Mar 1989. 5p. DOE Contract AC02-76CH03000. (CONF-881103–61: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988). Order Number DE89011471/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Design and performance of a 4.2 radiation length lead-sandwich, gas tube hodoscope are discussed. The device, measuring 1 x 2 m^2 in area and 12 cm in depth, was employed in Fermi National Accelerator Laboratory experiment 705. Multiple samplings of anode wires situated within three-walled aluminum tubes were used to generate an X coordinate; similarly, capacitively coupled copper-clad strips were ganged together to yield a Y coordinate. The results reviewed are based on an analysis of electron calibration data taken during a recent six-month running period. In particular, position resolution (in millimeters) is seen to be $0.8 + 3.3/\sqrt{E} + 31/E$ for the 9.92 mm spaced wires and $0.6 + 3.2/\sqrt{E} + 32/E$ for the 12.5 mm strips, where E represents the electron beam energy in GeV. 5 refs., 6 figs.

26974 (INIS-BR–1458, pp. 59) **Optimization of the time of flight geometry for fast neutrons.** Ghose, A.M. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

TIME-OF-FLIGHT SPECTROMETERS/fast neutrons; TIME-OF-FLIGHT SPECTROMETERS/geometry; TIME-OF-FLIGHT SPECTROMETERS/optimization; ELASTIC SCATTERING; INELASTIC SCATTERING; MEV RANGE 10-100; GEOMETRY; OPTIMIZATION

26975 (INIS-BR–1458, pp. 66) **Novel techniques for designing gas proportional scintillation counters for X-ray spectrometry.** Santos, J.M.F. dos (Coimbra Univ. (Portugal). Dept. of Physics); Dias, T.H.V.T.; Cortes, S.D.A.R.; Conde, C.A.N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAS SCINTILLATION DETECTORS/proportional counters; GAS SCINTILLATION DETECTORS/specifications; PROPORTIONAL COUNTERS/gas scintillation detectors; PROPORTIONAL COUNTERS/specifications; ENERGY RESOLUTION; SPECIFICATIONS; X-RAY DETECTION; X-RAY FLUORESCENCE ANALYSIS; XENON

26976 (INIS-BR–1458, pp. 30) **K X-ray satellite spectrum of Cs excited by photons.** Murty, V.R.K. (Andhra Univ., Visakrapatnam (India). Coll. of Engineering); Parlhasaradki, K.; Murti, M.V.R.; Rao, K.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALCIUM/excitation; CALCIUM/x-ray spectra; CALCIUM; EXCITATION; ELECTRONS; ENERGY SPECTRA; LITHIUM FLUORIDES; PHOTONS; PROTONS; SPECTROMETERS

26977 (INIS-BR–1458, pp. 58) **Neutron energy spectrum measurements of neutron sources with NE-213 spectrometer.** Coelho, P.R.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Silva, A.A. da; Maiorino, J.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

AMERICIUM/beryllium; AMERICIUM/neutron sources; BERYLLIUM/americium; BERYLLIUM/neutron sources; CALIFORNIUM 252/neutron sources; CALIFORNIUM 252/neutron spectra; DEUTERON REACTIONS/neutron sources; DEUTERON REACTIONS/neutron spectra; DEUTERON REACTIONS/tritium target; NEUTRON SOURCES/neutron spectra; NEUTRON SOURCES/neutron spectrometers; AMERICIUM; BERYLLIUM; COMPUTER CALCULATIONS; F CODES; LIQUID SCINTILLATORS; VAN DE GRAAFF ACCELERATORS

26978 (INIS-BR–1458, pp. 52) **X-ray microscopy with synchrotron light sources.** Jones, K.W. (Brookhaven National Lab., Upton, NY (USA)); Rivers, M.L.; Gordon, B.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MICROSCOPY/synchrotron radiation sources; MICROSCOPY/x radiation; SYNCHROTRON RADIATION SOURCES/microscopy; MICROSCOPY; PHOTON BEAMS

26979 (INIS-BR–1458, pp. 63) **Application of low pressure proportional counters to the study of low energy X-ray dosimetry.** Waker, A.J. (Leeds Univ. (UK). Dept. of Medical Physics); Eivazi, M.T. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PROPORTIONAL COUNTERS/x-ray dosimetry; LOW PRESSURE

26980 (INIS-BR–1458, pp. 64) **Position - sensitive proportional counter of charge - division type and its application to crystal spectrometer for soft X-rays.** Katano, R. (Kyoto Univ. (Japan)); Ito, S.; Kishimoto, S.; Isozumi, Y. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POSITION SENSITIVE DETECTORS/soft x radiation; POSITION SENSITIVE DETECTORS/x-ray spectrometers; ENERGY RESOLUTION

26981 (INIS-BR–1458, pp. 65) **Helium-filled proportional counter for cryogenic resonance electron Moessbauer spectroscopy.** Isozumi, Y. (Kyoto Univ. (Japan)); Fujii, T.; Katano, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PROPORTIONAL COUNTERS/helium; PROPORTIONAL COUNTERS/moessbauer effect; PROPORTIONAL COUNTERS/ultralow temperature; GASES; HELIUM

26982 (INIS-BR–1458, pp. 68) **Z-identification of charged particles by signal risetime in silicon surface barrier detectors.** England, J.B.A. (Birmingham Univ. (UK). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

SURFACE BARRIER DETECTORS/charged particle detection; SURFACE BARRIER DETECTORS/particle discrimination; SURFACE BARRIER DETECTORS/pulse rise time; TIME MEASUREMENT

26983 (INIS-BR–1458, pp. 70) **Passivation of digitally position sensitive Si(Li) - detectors.** Santos, W.M.S. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Fisica); Protic, D.; Riepe, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LI-DRIFTED SI DETECTORS/passivation; LI-DRIFTED SI DETECTORS/position sensitive detectors; POSITION SENSITIVE DETECTORS/li-drifted si detectors; POSITION SENSITIVE DETECTORS/passivation; FABRICATION; PASSIVATION

26984 (INIS-BR–1458, pp. 71) **Determination of Compton continuum from experimental efficiency curves of intrinsic germanium detectors.** Pani, R. (Universidade La Sapienza, Rome (Italy). Dept. di Medicina Sperimentale); Soluri, A.; Rubio, M.; Pellegrini, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COMPTON EFFECT/energy spectra; COMPTON EFFECT/x radiation; GE SEMICONDUCTOR DETECTORS/compton effect; GE SEMICONDUCTOR DETECTORS/efficiency; EFFICIENCY; IRRADIATION; KEV RANGE 10-100; KLEIN-NISHINA FORMULA; MONTE CARLO METHOD; PHOTONS

26985 (INIS-BR–1458, pp. 76) **Dependence of sensitivity of cellulose nitrate (R) and makrofol-E polycarbonate plastic detectors on etching temperature.** Farid, S.M. (Rajshahi Univ. (Bangladesh). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DIELECTRIC TRACK DETECTORS/etching; DIELECTRIC TRACK DETECTORS/sensitivity; DIELECTRIC TRACK DETECTORS/temperature dependence; NITRATES/dielectric track detectors; POLYCARBONATES/dielectric track detectors; ACTIVATION ENERGY; COMPUTER CALCULATIONS; ETCHING; SENSITIVITY; ENERGY LOSSES; HEAVY IONS; NITRATES; POLYCARBONATES; RANGE

26986 (INIS-BR–1458, pp. 90) **New ionization chambers for beta and X-radiation.** Albuquerque, M. da P.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Caldas, L.V.E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

IONIZATION CHAMBERS/beta particles; IONIZATION CHAMBERS/x radiation; ALUMINIUM; ELECTRODES; ENERGY DEPENDENCE; GRAPHITE; PERFORMANCE; STRONTIUM 90; YTTRIUM 90

26987 (INIS-BR–1458, pp. 78) **Simultaneous determination of dose and elapsed time since irradiation using $CaSO_4$: dy thermoluminescent dosimeters.** Furetta, C. (CERN, Geneva (Switzerland)); Azorin, J. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALCIUM SULFATES/radiation doses; CALCIUM SULFATES/thermoluminescent dosemeters; THERMOLUMINESCENT DOSEMETERS/calcium sulfates; THERMOLUMINESCENT DOSEMETERS/radiation doses; COMPUTER CALCULATIONS; IRRADIATION; TIME MEASUREMENT

26988 (INIS-BR–1458, pp. 80) **Thermoluminescent sensitivity of LIF: Mg, Cu.** Fonseca Fausto, A.M. da (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Yoshimura, E.M.; Okuno, E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LITHIUM FLUORIDES/doped materials; LITHIUM FLUORIDES/thermoluminescent dosemeters; THERMOLUMINESCENT DOSEMETERS/gamma radiation; THERMOLUMINESCENT DOSEMETERS/sensitivity; COPPER; GLOW CURVE; HEAT TREATMENTS; IMPURITIES; IRRADIATION; MAGNESIUM; TEMPERATURE DEPENDENCE; THERMOLUMINESCENCE; SENSITIVITY

26989 (INIS-BR–1458, pp. 81) **New pulsed pyroelectric radiation dosimeter.** Carvalho, A.A. de (UNESP, Ilha Solteira, SP (Brazil)); Mascarenhas, S.; Paula, M.H. de. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RITAD DOSEMETERS/specifications; PREAMPLIFIERS; SPECIFICATIONS; X RADIATION

26990 (INIS-BR–1458, pp. 82) **New pulsed photoacoustical radiation dosimeter.** Carvalho, A.A. de (UNESP, Ilha Solteira, SP (Brazil)); Mascarenhas, S.; Paula, M.H. de. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DOSEMETERS/photoacoustic effect; DOSEMETERS/specifications; DOSEMETERS; SPECIFICATIONS; RADIATION DOSES; SENSITIVITY; X RADIATION

26991 (INIS-BR–1458, pp. 83) **Calibration of a photoacoustical radiation dosimeter.** Carvalho, A.A. de (UNESP, Ilha Solteira, SP (Brazil)); Mascarenhas, S.; Paula, M.H. de. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics Absttracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DOSEMETERS/calibration; DOSEMETERS/photoacoustic effect; DOSEMETERS; CALIBRATION; X RADIATION

26992 (INIS-BR–1458, pp. 85) **Improvement of the calibration technique of clinical dosemeters by components.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Albuquerque, M. da P.P.; Xavier, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DOSEMETERS/calibration; CAPACITORS; DOSEMETERS; CALIBRATION; ELECTROMETERS; IONIZATION CHAMBERS; RADIATION SOURCES; STRONTIUM 90

26993 (INIS-BR–1458, pp. 115) **X-ray spectral determination by successive modifications of the beam intensity.** Mainardi, R.T. (Universidad Nacional de Cordoba (Argentina)); Barrea, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X-RAY SPECTRA/beam luminosity; X-RAY SPECTRA/iterative methods; X-RAY SPECTRA/measuring methods; FOILS; IONIZATION CHAMBERS; METALS; X-RAY TUBES

26994 (INIS-BR–1458, pp. 117) **External Bremsstrahlung spectra excited by Sr-89 and Tl-204 beta rays in some rare earth and other elements.** Rao, C.R. (Andhra Univ., Waltair (India). Dept. of Nuclear Physics); Narasimha Murty, K.; Parakash, S.; Sayibaba, T. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BREMSSTRAHLUNG/beta particles; BREMSSTRAHLUNG/spectra; STRONTIUM 89/beta particles; THALLIUM 204/beta particles; BREMSSTRAHLUNG; SPECTRA; EFFICIENCY; EXCITED STATES; HIGH-PURITY GE DETECTORS; MULTI-CHANNEL ANALYZERS; RARE EARTHS

26995 (INIS-BR–1458, pp. 170) **Densitometry in medical radiation physics: a Nigerian experience.** Bassey, C.E. (Ilorin Univ. (Nigeria)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DENSITOMETERS/diagnosis; DENSITOMETERS/radiology; X-RAY EQUIPMENT/diagnosis; DENSITOMETERS; DIAGNOSIS; RADIOLOGY; NIGERIA; PERSONNEL MONITORING; QUALITY CONTROL; SPECIFICATIONS

26996 (INIS-BR–1458, pp. 171) **Comparative study on calibration methods for detectors used in neutron radio protection dosimetry.** Oliveira, A.H. de (Minas Gerais Univ., Belo Horizonte (Brazil)); Del Vigna Filho, E.; Herbaut, I. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BF3 COUNTERS/calibration; BF3 COUNTERS/comparative evaluations; BF3 COUNTERS/neutron dosimetry; HE-3 COUNTERS/calibration; HE-3 COUNTERS/comparative evaluations; HE-3 COUNTERS/neutron dosimetry; AMERICIUM 241; BERYLLIUM; CALIBRATION; IRRADIATION; NEUTRON BEAMS; NEUTRON SOURCES; PLUTONIUM 239

26997 (INIS-BR–1458, pp. 186) **Radon measurement by electrostatic precipitation.** Pereira, E.B. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Silva, H.E. da. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADON/electrostatic precipitators; RADON/measuring methods; ALPHA PARTICLES; POLONIUM 214; POLONIUM 218; RADON; SPECIFICATIONS; SURFACE BARRIER DETECTORS

26998 (INIS-BR–1458, pp. 187) **On indoor radon contamination monitoring with plastic nuclear track detectors: the influence of plate-out effect.** Bigazzi, G. (Consiglio Nazionale delle Ricerche, Pisa (Italy). Ist. de Geocronologia e Geochimica Isotopica); Hadler Neto, J.C.; Paulo, S.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DIELECTRIC TRACK DETECTORS/positioning; RADON 222/dielectric track detectors; ALPHA PARTICLES; POSITIONING

26999 (INIS-BR–1458, pp. 193) **Some techniques for studying renal pathology due to urinary schistosomiasis.** Amuasi, J.H. (Ghana Atomic Energy Commission, Accra); Wilkins, H.A.; Crawley, J.C.W. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RENOGRAPHY/portable equipment; RENOGRAPHY/schistosomiasis; NAI DETECTORS; RENOGRAPHY; SCHISTOSOMIASIS

27000 (INIS-BR–1458, pp. 172) **Personnel dosimeter intercomparison at Latin American level.** Stuardo, E. (Comision Chilena de Energia Nuclear, Santiago); Oyarzun, C.; Palma, A.; Penaloza, H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PHOTOGRAPHIC FILM DOSEMETERS/calibration standards; PHOTOGRAPHIC FILM DOSEMETERS/interlaboratory comparisons; PHOTOGRAPHIC FILM DOSEMETERS/personnel dosimetry; THERMOLUMINESCENT DOSEMETERS/calibration standards; THERMOLUMINESCENT DOSEMETERS/interlaboratory comparisons; THERMOLUMINESCENT DOSEMETERS/personnel dosimetry; IRRADIATION; LATIN AMERICA; RADIATION DOSES

27001 (INIS-BR–1458, pp. 185) **Radon studies in human environment using solid state nuclear track detectors.** Ramola, R.C. (Guru Nanak Dev Univ., Amritsar (India)); Sandhu, A.S.; Singh, S.; Virk, H.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADON/dielectric track detectors; RADON/environment; ALPHA DOSIMETRY; RADON; ENVIRONMENT

27002 (INIS-BR–1458, pp. 264) **γ-ray compton spectrometer at Bialystok Branch of the Warsaw University.** Plechta, J. (Warsaw Univ. (Poland)); Dobrzynski, L.; Krogulski, T.; Waliszewski; Zukowski, E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COMPTON SPECTROMETERS/specifications; CESIUM 137; SPECIFICATIONS; COMPUTERS; GAMMA SOURCES; GE SEMICONDUCTOR DETECTORS; GOLD 198; KEV RANGE 100-1000; VACUUM SYSTEMS

27003 (INIS-BR–1458, pp. 201) **Radiographic image analysis techniques.** Jennings, R.J. (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

IMAGE PROCESSING/efficiency; IMAGE PROCESSING/nuclear medicine; COMPUTERIZED TOMOGRAPHY; EFFICIENCY; IMAGE SCANNERS; NMR IMAGING

27004 (INIS-BR–1458 II.23) **Thermoluminescent characteristics of $CaSO_4$: Dy + PTFE dosemeters produced at ININ.** Azorin, J. (Instituto Nacional de Investigaciones Nucleares, Mexico City); Gutierrez, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALCIUM SULFATES/thermoluminescent dosemeters; THERMOLUMINESCENT DOSEMETERS/activation energy; THERMOLUMINESCENT DOSEMETERS/glow curve; SINTERING

27005 (INIS-mf–11406, pp. 47) **Search for photo-transferred luminescence in two TL phosphors.** Ben-Shachar, B. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering); Hoffman, J.; Catchen, G.L. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PHOSPHORS/photosensitivity; BORATES; CALCIUM SULFATES; IONIZING RADIATIONS; LITHIUM FLUORIDES; PHOSPHORS; PHOTOSENSITIVITY; PHOTOLUMINESCENCE; RADIATION DOSES; THERMOLUMINESCENT DOSEMETERS; ULTRAVIOLET RADIATION

27006 (INIS-SU–77/A, pp. 100-101) **Polarized resonance neutron spectrometer.** Biryukov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Bondarenko, L.N.; Danelyan, L.S. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The parameters of a polarized neutron spectrometer created on the basis of high-current linac FAKEL are given. The neutron beam is polarized by passing through a dynamically polarized proton target based on ethylene glycol. The achieved neutron beam polarization equals about 50%. 3 refs.

27007 (INIS-SU–77/A, pp. 163-167) **Neutron interferometers with diffraction gratings.** Ioffe, A.I. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Zabiyakin, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A practical realization of a difraction - grating neutron interferometer is described. Methods of increasing its luminosity are analyzed. Implementation of this principle for very low energy neutrons can permit a substantional expansion of the range of problems which can be solved by neutron interferometry methods. 6 refs.; 4 figs.

27008 (INIS-SU–79, pp. 79-84) **Start-up of the DIN-1 spectrometer after reconstruction.** Klemyshev, P.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Morozov, S.I.; Novikov, A.G. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Updated units of double pulsed neutron spectrometer DIN-1M: a mechanical chopper, a phasing system, a detector system, a measuring module, a sample chamber evacuation system, are described. The main characteristics of the device obtained during start-up works (monochromatic neutron intensity on a sample, resolution, background) are given. The updating results have revealed in improvement of reliability of spectrometer operation simplification, expansion of applications. The prospects of further improvement of working spectrometer parameters are discussed. 8 refs.; 4 figs.

27009 (JINR-R–9-88-149) **Analytical consideration and calculation of electrostatical system by reverse method.** Tarantin, N.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1988. 16p. (In Russian). Order Number DE88706319/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to the journal Zh. Tekh. Fiz.

Analytical consideration and following calculation of electrostatical systems for the optics and the analysis of charged particles by the reverse method are described and illustrated by new results. The profiles and electrical potentials of electrodes are determined from Maxwell equations and from analytical expression of the base field instead of the traditional determination of the electrical field from the given system of the electrodes from the solution of Laplas equation as Dirichlet problem. 10 refs.; 5 figs.; 1 tab,

27010 (JINR–R-10-88-241) **Fast and economic algorithms for special-purpose processors. Registration of summary signals in calorimeters.** Nikityuk, N.M. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1988. 12p. (In Russian). Order Number DE88706327/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results of the parallel methods of counting signals used in computers for construction of units for fast event extraction in high energy physics are described. The fast method for synthesis of parallel counters for a large number of inputs is given. Main parameters of the parallel counters for the number of inputs from 3 to 127 is calculated. It is shown that parallel data compressors can be constructed on the basis of parallel counters which can be used for simultameous summing of a large number of terms. The data compressors can be effectively used in the calorimeters for summation of a great number of terms. 11 refs.; 9 figs.; 1 tab.

27011 **Neutron range spectrometer.** Manglos, S.H. To Dept. of Energy. USA Patent Application 7-166,581. 10 Mar 1988. 12p. DOE Contract AC04-76DP03533. Order Number DE89010813/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A neutron range spectrometer and method for determining the neutron energy spectrum of a neutron emitting source are disclosed. Neutrons from the source are colliminated along a collimation axis and a position sensitive neutron counter is disposed in the path of the collimated neutron beam. The counter determines positions along the collimation axis of interactions between the neutrons in the neutron beam and a neutron-absorbing material in the counter. From the interaction positions, a computer analyzes the data and determines the neutron energy spectrum of the neutron beam. The counter is preferably shielded and a suitable neutron-absorbing material is He-3. 1 fig.

27012 (SAND–88-2327) **Technique and data analysis for impact-loaded piezoelectric polymers (PVDF).** Anderson, M.U.; Wackerbarth, D.E. Sandia National Labs., Albuquerque, NM (USA). Sep 1988. 71p. DOE Contract AC04-76DP00789. Order Number DE89010529/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A standardized piezoelectric polymer (PVDF) shock-wave stress gauge has been developed in cooperation between Sandia and the Institute Saint Louis, France. The shock response of these gauges is established from controlled shock-loading experiments in which impact-induced current pulses are measured with high speed digitizers. This report documents the preparation and assembly of PVDF gauges to be used in these controlled shock-loading experiments, and a computer program "PVDF-AUTO" written for analysis of the

data obtained in such experiments. Due to digitizer noise before and after actual gauge output, it is often difficult to distinguish the data points at which the loading pulse begins, ends, and the unloading pulse arrives. It is the purpose of this data analysis program to identify these points in an objective manner that is mathematically documented and free from human judgement, thus analyzing data consistently regardless of experimental conditions.

27013 (SAND–88-2697C) **Pressure calibration and certification of a quartz pressure transducer.** Husa, S. Sandia National Labs., Albuquerque, NM (USA). 1988. 13p. DOE Contract AC04-76DP00789. (CONF-890589–1: 35. international instrumentation symposium, Orlando, FL, US, May 30, 1989). Order Number DE89005774/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The calibration and certification of a 0–15 psia microprocessor controlled quartz pressure transducer using an air piston gage primary standard is discussed. The calibration includes a discussion of the primary standard, setup of the test, and data acquisition and reduction. The certification includes the establishment of a total calibration uncertainty for the device and an interval over which the certification is valid. Factors contributing to the total calibration uncertainty of a device include the systematic uncertainties of the calibration equipment, history of the device itself, and history of similar devices. Typical systematic uncertainties of the calibration system are on the order of 0.011% and the typical total uncertainty assigned to the transducer is less than 0.030% over a one-year interval. 4 refs., 1 fig., 3 tabs.

27014 A high resolution streamer chamber for use in heavy quark studies. Majka, R.D. (Yale Univ., Physics Dept., New Haven, CT (US)); Disco, A.A.; Hissong, J.G.; Rotondo, F.S.; Sandweiss, J.; Slaughter, A.J.; Wolin, E.J. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 63-65 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

For several years the authors have been developing the diffusion suppressed streamer chamber for use as a triggerable vertex detector in heavy quark studies. This streamer chamber makes use of a novel technique the author's have developed to substantially improve the resolution of a high pressure streamer chamber. Conventional streamer chambers which operate at one atmosphere have streamers with 1 - 2mm diameters. This size can be reduced by operating the chamber at high pressure. The streamer diameter will be reduced by about 1/p (p = pressure in atm.).

27015 Use of proportional tubes in a muon polarimeter. Kenney, C.J. (The College of William and Mary Williamsburg, VA (US)); Eckhause, M.; Ginkel, J.F.; Guss, P.P.; Kane, J.R.; Vulcan, W.F.; Welsh, R.E.; Whyley, R.J.; Bilskie, J.; Hart, G.W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 74-78 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A prototype muon polarimeter was built to study the feasibility of measuring the positive muon polarization in the decay $K_L \rightarrow \mu^+\mu^-$. The system consisted of alternating layers of extruded aluminum gas proportional tubes and polarization-retaining absorber plates of either aluminum or marble. Longitudinally polarized positive muons from the Stopped Muon Channel at the Clinton P. Anderson Meson Physics Facility (LAMPF) were stopped in the absorber plates where they precessed in a field of 60 gauss. Decay times were recorded in 100 ns first-in-first-out memories for all wires hit during a 12.8 μs period centered about the muon stop trigger. The performance of the system was studied for different beam rates and absorber thicknesses. The value of imposing time and spacial cuts on track data to enhance the precession signal was also investigated.

27016 A TPC for large solid angle relativistic ion experiments. Etkin, A. (Brookhaven National Lab., NY (US)); Eiseman, S.E.; Foley, K.J.; Lindenbaum, S.J.; Chan, C.S.; Kramer, M.A.; Hallman, T.J.; Madansky, L.; Bonner, B.E.; Buchanan, J.A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 58-62 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A TPC detector system has been developed to function in the very high multiplicity environment of relativistic heavy ion experiments. A TPC was chosen because it directly gives 3-dimensional points on the tracks which is a very significant help for track finding. Of prime importance is a combination of high efficiency, low noise and two-track resolution capability. A significant development is a system of hybridized high sensitivity on chamber digitizing electronics. A description of the TPC modules, the digitizing electronics and test results are given.

27017 Design and performance characteristics of the E769 beamline transition radiation detector. Errede, D. (Univ. of Wisconsin, Madison, WI (US)); Sheaff, M.; Fenker, H.; Lueking, L.; Mantsch, P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 106-111 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A Transition Radiation Detector (TRD) was designed and built for E769, a Fermilab Fixed Target experiment, for use in separating pions from protons or kaons in a 250 GeV/c positive beam at the Tagged Photon Laboratory (TPL). Requirements placed on the detector were that it operate in a high rate ($\approx$2 MHz) environment and that it be relatively easy to build since it had to be ready approximately one year from the date of its inception. The short time available precluded exposing prototypes to a test beam making it necessary to rely on source testing and Monte Carlo programs to predict the detector performance. When operated in the beam, the detector performance was in good agreement with these predictions. For a pion detection efficiency of 87%, the contamination by protons of a sample of TRD tagged pions was 2%.

27018 Cerium fluoride, a new fast, heavy scintillator. Moses, W.W. (Donner Lab. and Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Derenzo, S.E. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 173-176 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

The authors describe the scintillation properties of Cerium Fluoride (CeF_3), a newly discovered, heavy (6.16 g/cm^3), inorganic scintillator. Its fluorescence decay lifetime, measured with the delayed coincidence method, is described by a single exponential with a 27 $\pm$ 1 ns time constant. The emission spectrum peaks at a wavelength of 340 nm, and drops to less than 10% of its peak value at 315 nm and 460 nm. When a 1 cm optical quality cube of CeF_3 is excited with 511 keV photons, a photopeak with a 20% full width at half maximum is observed at approximately half the light output of a Bismuth Germanate (BGO) crystal with similar geometry. They also present measurements of the decay time and light output of CeF_3 doped with three rare-earth elements (Dy, Er, and Pr). The short fluorescence lifetime, high density, and reasonable light output of this new scintillator suggest that it would be useful for applications where high counting rates, good stopping power, and nanosecond timing are important, such as medical imaging and nuclear science.

27019 Computer controlled drifting of Si(Li) detectors. Landis, D.A. (Lawrence Berkeley Lab., Berkeley, CA (US)); Wong, Y.K.; Walton, J.T.; Goulding, F.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 185-189 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A relatively inexpensive computer-controlled system for performing the drift process used in fabricating Si(Li) detectors is described. The system employs a small computer to monitor the leakage current, applied voltage and temperature on eight individual drift stations. The associated computer program initializes the drift process, monitors the drift progress and then terminates the drift when an operator set drift time has elapsed. The improved control of the drift with this system has been well demonstrated over the past three years in the fabrication of a variety of Si(Li) detectors. A few representative system responses to detector behavior during the drift process are described.

27020 A variable temperature cryostat that produces in situ clean-up of germanium detector surfaces. Pehl, R.H. (Lawrence Berkeley Lab., Berkeley, CA (US)); Madden, N.W.; Malone, D.F.; Cork, C.P.; Landis, D.A.; Xing, J.S.; Friesel, D.L. *IEEE (Institute of*

Electrical and Electronics Engineers) Transactions on Nuclear Science (USA), 36(1): 190-193 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Variable temperature cryostats that can maintain germanium detectors at temperatures from 82 K to about 400 K while the thermal shield surrounding the detectors remains much colder when the detectors are warmed have been developed. Cryostats such as these offer the possibility of cryopumping material from the surface of detectors to the colder thermal shield. The diode characteristics of several detectors have shown very significant improvement following thermal cycles up to about 150 K in these cryostats. Important applications for cryostats having this attribute are many.

27021 An IC-compatible detector process. Holland, S. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 282-289 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A silicon radiation-detector fabrication process which exploits the excellent gettering properties of a backside layer of phosphorus-doped polysilicon has been developed and characterized. 2 mm diameter p-i-n diodes have been fabricated with typical reverse-bias current densities of approximately 1 nA/cm^2. In addition, a strip detector with 128 strips of 6 mm length on a 55 μm pitch has been successfully fabricated with better than 10% uniformity in the diode reverse-bias currents. The process is compatible with conventional integrated-circuit fabrication technologies, and p-channel enhancement and depletion-mode MOSFETs with associated inter-device isolation have been fabricated simultaneously on detector-grade silicon with p-i-n radiation detectors.

27022 Charge trapping correction in Ge spectrometers. Simpson, M.L. (EG and G ORTEC, Oak Ridge, TN (US)); Raudorf, T.W.; Paulus, T.J.; Trammell, R.C. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 260-266 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

In the present work, a charge trapping model is developed which does not require the assumption of shallow level detrapping. The model shows the charge trapping deficit to be proportional to $S_o t_{coll}^N$, where S_o is the peak amplitude of the shaping amplifier pulse, t_{coll} is the charge collection time for the carrier being trapped, and $1.5 < N < 3$ for most practical cases. A class of circuits to correct for charge trapping was developed and tested; the results were used to evaluate the main features of the model. A radiation damaged, conventional electrode detector and a reverse electrode detector, which exhibited a significant amount of deep-level, majority carrier charge trapping, were used to evaluate the usefulness of the circuits.

27023 Spiral silicon drift detectors. Rehak, P. (Brookhaven Nat. Lab., Upton, NY (US)); Gatti, E.; Longoni, A.; Sampietro, M.; Holl, P.; Lutz, G.; Kemmer, J.; Prechtal, U.; Ziemann, T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 203-209 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

An advanced large area silicon photodiode (and X-ray detector), called Spiral Drift Detector, was designed, produced and tested. The Spiral Detector belongs to the family of silicon drift detectors and is an improvement of the well known Cylindrical Drift Detector. In both detectors, signal electrons created in silicon by fast charged particles or photons are drifting toward a practically point-like collection anode. The capacitance of the anode is therefore kept at the minimum (0.1pF). The concentric rings of the cylindrical detector are replaced by a continuous spiral in the new detector. The spiral geometry detector design leads to a decrease of the detector leakage current. In the spiral detector all electrons generated at the silicon-silicon oxide interface are collected on a guard sink rather than contributing to the detector leakage current. The decrease of the leakage current reduces the parallel noise of the detector. This decrease of the leakage current and the very small capacitance of the detector anode with a capacitively matched preamplifier may improve the energy resolution of Spiral Drift Detectors operating at room temperature down to about 50 electrons rms. This resolution is in the range attainable at present only by cooled semiconductor detectors.

27024 Studies of the LBL CMOS integrated amplifier/discriminator for randomly timed inputs from fixed target experiments. Russ, J.S. (Carnegie-Mellon Univ. (US)); Yarema, R.J.; Zimmerman, T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 477-483 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

A group at Lawrence Berkeley Laboratory has reported an elegant CMOS VLSI circuit for amplifying, discriminating, and encoding the signals from highly-segmented charge output devices, e.g., silicon strip detectors or pad readout structures in gaseous detectors. The design exploits switched capacitor circuits and the well-known time structure of data acquisition in colliding beam accelerators to cancel leakage effects and switching noise. For random inputs, these methods are not directly applicable. However, the high speed of the reset switches makes possible a mode of operation for fixed target experiments that uses fast resets to erase unwanted data from random triggers. Data acquisition in this mode has been performed. Details of operation and measurements of noise and rate capability will be presented.

27025 VAXGAP. William, E.W. (Idaho National Engineering Lab., EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID (US)); Hartwell, J.K. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 615-619 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

VAXGAP (VAX Gamma-ray Analysis Package) is a collection of computer programs for the analysis of pulse height spectra acquired on Ge detector-based spectrometers. VAXGAP was written to provide the operators of a radiation measurements laboratory with the necessary software tools for routine analysis of radioactive samples through the analysis of gamma-ray pulse-height spectra. A detailed description of the algorithms used in VAXGAP is presented elsewhere. This paper summarizes the unique features and the organization of VAXGAP which makes it of particular value in the routine analysis of spectra.

27026 The liquid argon calorimeter system for the SLC large detector. Haller, G.M. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA (US)); Fox, J.D.; Smith, S.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 675-679 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

In this paper the physical packaging and the logical organization of the Liquid Argon Calorimeter (LAC) electronics system for the Stanford Linear Collider Large Detector (SLD) at SLAC are described. This system processes signals from approximately 44,000 calorimeter towers and is unusual in that most electronic functions are packaged within the detector itself as opposed to an external electronics support rack. The signal path from the towers in the liquid argon through the vacuum to the outside of the detector is explained. The organization of the control logic, analog electronics, power regulation analog-to-digital conversion circuits, and fiber optic drivers mounted directly on the detector are described. Redundancy considerations for the electronics and cooling issues are discussed.

27027 Prototype VME data acquisition card for the ZEUS calorimeter. Dawson, J.W. (High Energy Physics Div., Argonne National Lab., Argonne, IL (US)); Berg, J.S.; Schlereth, J.L.; Stanek, R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 638-642 (Feb 1989). (CONF-881103--: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

This paper discusses the design of a prototype data acquisition (DAQ) card for the ZEUS calorimeter. The card accepts two multiplexed analog data streams at a 1 MHz rate, and digitizes and stores the data for subsequent transfer through VME to a host computer. The data is buffered by a high-speed asynchronous FIFO following the A/D converters, and written into Data Memory on the card, either directly or after processing by an on-board digital signal processors (DSP). Each card has a 16-bit control-status register (CSR), the bits of which configure the hardware and define the

hardware options. The 1/4 Mbyte of high speed CMOS static RAM appears either as a FIFO, or mapped memory depending upon a bit in the CSR. The card is designed to make use of the 32-bit data and address buses supported by VME, and accordingly can be most efficiently utilized in conjunction with a processor in the VME environment such as the 68020, which supports longword transfers in a 32-bit address space. The card is constructed on a ten layer printed circuit, with almost all components being surface-mount devices. All logic is implemented in PLD's.

27028 High amplitude events in microchannel plates. Siegmund, O.H.W. (Space Sciences Lab., Univ. of California, Berkeley, CA (US)); Lammert, P.; Vallerga, J.V.; Priedhorsky, W.; Smith, B.W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 830-835 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Measurements have been made to determine the characteristics of high amplitude events in microchannel plates (MCP's). The background pulse amplitude spectrum is found to extend to >30x the MCP modal gain. The majority of the background events are initiated by ^{40}K beta decay in the MCP glass. However, up to 4% of the events are due to cosmic ray events. Comparison of background pulse amplitude spectra for horizontal, and vertical MCP orientations suggests that the largest events are predominantly cosmic ray induced. Anticoincidence measurements confirm this result. A model describing the ^{40}K beta decay and cosmic ray interactions in the MCP predicts spectra in accord with these observations. The authors have also determined the response of MCP's when subjected to simultaneous multiphon input. This shows that pulse amplitudes many times the modal gain are possible even though the response becomes nonlinear at high amplitudes.

27029 Pulser injection with subsequent removal. Hartwell, J.K. (Idaho National Engineering Lab., (INEL) Idaho Falls, ID (US)); Goodwin, S.G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 801-805 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Electronic pulser injection has found wide application in Ge detector gamma-ray spectrometry for dead time and pulse pileup loss correction and for calculation or stabilization of the system gain and zero. The authors use a technique of pulser injection with subsequent removal from the gamma-ray spectrum that provides the benefits of pulser injection without the requirement for prior spectral definition. The technique is functionally similar to the leaky discriminators method in its storage of pulser events in regions of the gamma-ray spectrum forbidden to gamma-ray events; however, the INEL technique uses digital logic in a special pulser control and separation module to modify (or not modify) ADC addressed based on pulser-tagging logic signals. This technique allows truly automatic and even unattended gamma-ray spectrometry.

27030 Waveform digitizing at 500 MHz. Atiya, M. (Dept. of Physics, Brookhaven National Lab., Upton, NY (US)); Ito, M.; Haggerty, J.; Ng, C.; Sippach, F.W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 813-817 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

Experiment E787 at Brookhaven National Laboratory is designed to study the decay $K^+ \rightarrow \pi^+\nu\bar{\nu}$ to a sensitivity of 2×10^{-10}. To achieve acceptable muon rejection it is necessary to couple traditional methods (range/energy/momentum correlation) with observation of the decay sequence in scintillator. The authors report on the design and construction of over 200 channels of relatively low cost solid state waveform digitizers. The distinguishing features are: 8 bits dynamic range, 500 MHz sampling, zero suppression on the fly, deep memory (up to .5 msec), and fast readout time (100 μsec for the entire system). The authors report on data obtained during the February-May 1988 run showing performance of the system for the observation of the above decay.

27031 Comparison of measured responses in two spectrally-sensitive X-ray detectors to predictions obtained using the its radiation transport code. Carlson, G.A. (Sandia National Labs., Albuquerque, NM (US)); Beutler, D.E.; Seager, K.D.; Knott, D.P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1272-1277 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

Responses of a Ge detector and a filtered TLD array detector have been measured at a steady-state bremsstrahlung source (the Pelletron), at endpoint energies from 150 to 900 keV. Predictions of detector response using Monte Carlo ITS codes are found to be in excellent agreement with measured responses for both detectors. These results extend the range of validity of the ITS codes. With calibration provided by these experiments and by ITS predictions, dose-depth data from the TLD arrays can be used to estimate flash X-ray source endpoint energies.

27032 Radiation environment of HERMES III. Halbleib, J.A. (Sandia National Labs., Albuquerque, NM (US)); Sanford, T.W.L.; Poukey, J.W. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1282-1287 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

A model that has been tested experimentally on HELIA is used to predict the radiation environment of the HERMES III gamma-ray simulator. This model demonstrates the potential capability that HERMES III will have for generating intense, uniform radiation exposures over areas from 500 to 2500 cm^2. Initial experiments at reduced voltage using a graphite anode-converter beam dump at a rate of five shots per day are encouraging and confirm the validity of the model for the design and analysis of future experiments on HERMES III. Scaling to design voltage and a tantalum converter indicates that design specifications can be met.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 26795, 27654, 27656, 27657, 27658, 27660

27033 Radiation aging studies of CO_2 hydrocarbon mixtures for the SLD drift chamber. Venuti, J.P. (Vanderbilt Univ., Nashville, TN (US)); Chadwick, G.B. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 595-601 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

The SLD drift chamber require a slow drifting gas and low diffusion to allow wave form digitization. CO_2 provides this but requires an admixture of a quencher to provide more gain. A test chamber with an 8 sense wire cell, such as will appear in the final chamber, was exposed to an X-ray tube while containing a variety of binary admixtures of CO_2: 8% isobutane, 8% ethane, and 2% isopropanol. It was determined that adding small fractions of water ($\leq$0.66%) or isopropanol (1-2%) to the CO_2: 8% ethane, or 8% isobutane extended the useful life of the chamber so that integrated charge collections of –1 C/cm are permissible. Results and discussions are presented.

27034 Temperature effects on the radiation response of MOS devices. Schwank, J.R. (Sandia National Labs., Albuquerque, NM (US)); Sexton, F.W.; Fleetwood, D.N.; Jones, R.V.; Flores, R.S.; Rodgers, M.S.; Hughes, K.L. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1432-1437 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The effect of device temperature during irradiation has been investigated for MOS transistors and integrated circuits over the MIL-STD temperature range, -55 to 125°C. Large, qualitative changes in transistors and 16k SRAM response are observed both at high and low temperatures. Although changes in transistor response are generally consistent with one'e previous expectations, it is not always straightforward to predict circuit response as a function of temperature. For low dose rate (0.27 rad/s) irradiations of 16k SRAMs, the failure dose at 25°C is at least twice that of 125°C. This reduction in failure dose, as verified by SPICE simulation, is likely a result of a large increase in SRAM cell imbalance.

27035 Computer simulation of ionizing radiation burnout in power MOSFETs. Keshavarz, A.A. (Dept. of Electrical and Computer Engineering, Univ. of New Mexico, Albuquerque, NM (US)); Hawkins, C.F.; Fischer, T.A.; Dawes, W.R. Jr. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1422-1427 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The first computer simulation of the γ-induced burnout in power MOSFETs is reported here. The modeling results support the current-induced avalanche burnout mechanism at the interface of the epitaxial layer and the substrate coupled with parasitic bipolar transistor action leading to secondary breakdown and thermal runaway. The simulations allow an evaluation of the effects of semiconductor parameters, device geometry, doping profiles and bias voltage on the burnout dose rate threshold. The model provides a method for optimizing the radiation hardness of power MOSFETs.

27036 Using laboratory x-ray and cobalt-60 irradiations to predict CMOS device response in strategic and space environments. Fleetwood, D.M. (Sandia National Labs., Albuquerque, NM (US)); Winokur, P.S.; Schwank, J.R. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1497-1505 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The postirradiation response of CMOS transistors with 30-60 nm gate oxides is investigated as a function of radiation energy, total dose, dose rate, and annealing time. Measurements of threshold voltage, oxide-trapped charge, and interface traps are reported for times ranging from 10 ms to 4 months following LINAC, Co-60, Cs-137, and 10-keV x-ray irradiations. Exposure dose rates vary by 11 orders of magnitude: from 0.05 to 6 x 10^9 rad(SiO_2)/s. To within the $\pm$ 10 percent uncertainty in the overall dosimetry, no true dose rate effects on MOS device response are observed. Further, for these devices, interface trap and oxide-trapped charge densities are found to be linear with total dose. Based on these results, and subject to future verification, preliminary recommendations are made for lot acceptance testing of hardened CMOS circuits and devices intended for use in space and strategic environments. These include an endorsement of Co-60 exposure and elevated temperature annealing for qualification of devices for use in space environments and a recommendation for the use of x-ray exposures at dose rates greater than – 2000 rad (SiO_2)/s, in addition to Co-60 irradiations according to MIL-STD method 1019.3, for strategic applications. These tests are practical to implement, and should provide greatly improved confidence in CMOS performance in space and strategic applications over that obtained with MIL-STD 1019.3 testing.

27037 Total dose characterization of a CMOS technology at high dose rates and temperatures. Browning, J.S. (Sandia National Labs., Albuquerque, NM (US)); Connors, M.P.; Freshman, C.L.; Finney, G.A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1557-1562 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

Radiation hardened MOS ICs and transistors have been irradiated using several high dose rate sources. A strong dependence of the dose-to-failure level is observed for different circuit designs, the dose per pulse, package temperature and the average dose rate of the radiation source at ambient and elevated temperatures. These results indicate that predicting the IC response in a strategic environment may be more difficult than first believed.

27038 Post-irradiation effects in CMOS integrated circuits. Zietlow, T.C.; Barnes, C.E.; Morse, T.C.; Grusynski, J.S.; Nakamura, K.; Amram, A.; Wilson, K.T. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1662-1666 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The post-irradiation response of CMOS integrated circuits from three vendors has been measured as a function of temperature and irradiation bias. The author's have found that a worst-case anneal temperature for rebound testing is highly process dependent. At an anneal temperature of 80^{0}C, the timing parameters of a 16K SRAM from vendor A quickly saturate at maximum values, and display no further changes at this temperature. At higher temperature, evidence for the anneal of interface state charge is observed. Dynamic bias during irradiation results in the same saturation value for the timing parameters, but the anneal time required to reach this value is longer. CMOS/SOS integrated circuits (vendor B) were also examined, and showed similar behavior, except that the saturation value for the timing parameters was stable up to 105^{0}C. After irradiation to 10 Mrad(Si), a 16K SRAM (vendor C) was annealed at 80^{0}C. In contrast to the results from the vendor A SRAM, the access time decreased toward prerad values during the anneal. Another part irradiated in the same manner but annealed at room temperature showed a slight increase during the anneal.

4403 Miscellaneous Instruments

Refer also to citation(s) 26216, 26295, 26555, 26597, 26739, 26747, 26810, 26966, 27069, 27076, 27119, 27186, 27791

27039 (AGA–9010603) **The development of an ultralow frequency eddy current instrument for the detection and sizing of stress corrosion cracks: Final report.** Hayford, D.T. American Gas Association, Arlington, VA (USA). Pipeline Research Committee; Battelle Columbus Div., OH (USA). 4 May 1988. 72p. Available from American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 $50.00.

Eddy current testing has received only limited application to ferrous materials because the high permeability of the material in combination with the normally high frequency of the eddy current instrument results in a very small depth of penetration of the eddy currents into the material. The objectives of this research program were threefold. The first goal was to develop an eddy current instrument with frequencies low enough to penetrate pipeline steel. The second was to use the new instrument to develop techniques for locating stress-corrosion cracks (SCC) on coated pipelines without requiring the removal of the coating. Our last goal was to develop methods of characterizing SCC, i.e., determining the lengths and depths of the defects. We accomplished two out of these three goals; we were able to build the instrument and use it to detect SCC in pipelines. Simple defect characterization algorithms (measuring defect length and depth) have been more difficult to develop. At present we can estimate the depth of "long" defects (relative to the coil diameter) but have problems with shorter ones. 24 figs.

27040 (CU–C-154) **RF transmission line methods for feedstock moisture content determination.** Carleton Univ., Ottawa, Ontario (Canada). 1981. 85p. (CE–02495). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Bark residue, pine dust, and various combinations of wood chips are used as fuels by the pulp and paper industry to reduce energy costs. Efficient use of these fuels requires knowledge of their moisture contents to properly control their combustion. This report describes experimental work conducted to relate the moisture contents of fuel materials to phase shifts induced in radio-frequency (VHF-UHF) transmission lines in close proximity to the fuel. Both open parallel bar and leaky coaxial cable methods are considered. 24 figs., 22 tabs.

27041 (EPRI-EN–6188) **An optical particle counter for measuring small-particle flux: Final report.** Harrison, L.C.; Hubbe, J.M.; Doran, J.C. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 207p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This project was intended to design and produce a new version of an optical particle counter (OPC) that was well suited to the measurement of the dry deposition flux of small particles, i.e., those with diameters less than 1 μm. The OPC employed a nonresonant cavity for particle detection, using an He-Cd laser as a light source, and a sample flow rate of 10 cm^3/s or more. The system was designed to provide fast counting rates (50 kHz or more) that would improve the statistical accuracy of flux measurements over those possible with commercially available instruments. The electronics required for

these counting rates have been tested successfully, but the minimum size detection limit of the apparatus is larger than is necessary for good flux measurement. Values ranging between 0.12 and 0.17 μm have been achieved, depending on the noise levels of the light source. Limited field testing of the instrument has been carried out, although clean air generally made flux measurements impossible. Use of a more powerful laser would increase the signal-to-noise ratio to acceptable levels for field operation of the instrument. 5 refs., 7 figs., 1 tab.

27042 (INIS-BR–1458, pp. 87) **Concentration of low energy gamma rays for space astronomy.** Chiara, P. de (Universita de Ferrara (Italy)); Frontera, F.; Sgarzi, P. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA ASTRONOMY/feasibility studies; BRAGG REFLECTION; KEV RANGE 100-1000; SENSITIVITY

27043 **Flow cytometry apparatus.** Pinkel, D. To Dept. of Energy. USA Patent Application 7-126,153. 30 Nov 1987. 14p. DOE Contract W-7405-ENG-48. Order Number DE89010954/JAW. Available from NTIS, PC A03 - OSTI.

An obstruction across the flow chamber creates a one-dimensional convergence of a sheath fluid. A passageway in the obstruction directs flat cells near to the area of one-dimensional convergence in the sheath fluid to provide proper orientation of flat cells at fast rates. 6 figs.

27044 **Laser particle sorter.** Martin, J.C.; Buican, T.N. To Dept. of Energy. USA Patent Application 7-126,156. 30 Nov 1987. 16p. DOE Contract W-7405-ENG-36. Order Number DE89010956/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Method and apparatus are provided for sorting particles, such as biological particles. A first laser is used to define an optical path having an intensity gradient which is effective to propel the particles along the path but which is sufficiently weak that the particles are not trapped in an axial direction. A probe laser beam is provided for interrogating the particles to identify predetermined phenotypical characteristics of the particles. A second laser beam is provided to intersect the driving first laser beam, wherein the second laser beam is activated by an output signal indicative of a predetermined characteristic. The second laser beam is switchable between a first intensity and a second intensity, where the first intensity is effective to displace selected particles from the driving laser beam and the second intensity is effective to propel selected particles along the deflection laser beam. The selected particles may then be propelled by the deflection beam to a location effective for further analysis. 2 figs.

27045 **Fiber optic apparatus for detecting molecular species by surface enhanced Raman spectroscopy.** Angel, S.M.; Sharma, S.K. To Dept. of Energy. USA Patent Application 7-126,159. 30 Nov 1987. 21p. DOE Contract W-7405-ENG-48. Order Number DE89010957/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Optrode apparatus for detecting constituents of a fluid medium includes an optical fiber having a metal coating on at least a portion of a light transmissive core. The metal is one, such as silver, gold or copper, which enhances emission of Raman signal frequencies by molecules adsorbed on the surface of the coating when monochromatic probe light of a different frequency is scattered by such molecules and the metal coating is sufficiently thin to transmit light between the adsorbed molecules and the core of the fiber. Probe light is directed into one end of the fiber and a detector analyzes light emitted from the fiber for Raman frequencies that identify one or more particular molecular species. In one form, the optrode may function as a working electrode of an electrochemical cell while also serving to detect the products of oxidation or reduction reactions which occur at the electrode surface. 6 figs.

27046 **A radio frequency coaxial feedthrough.** Owens, T.L. To Dept. of Energy. USA Patent Application 7-129,209. 7 Dec 1987. 15p. DOE Contract AC05-84OR21400. Order Number DE89010959/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An improved radio frequency coaxial transmission line vacuum feedthrough is provided based on the use of a half-wavelength annular dielectric pressure barrier disk, or multiple disks comprising an effective half wavelength structure to eliminate reflection from the barrier surfaces. Gas-tight seals are formed about the outer and inner diameter surfaces of the barrier disk using a sealing technique which generates radial forces sufficient to form seals by forcing the conductor walls against the surfaces of the barrier disks in a manner which does not deform the radii of the inner and outer conductors, thereby preventing enhancement of the electric field at the barrier faces which limits the voltage and power handling capabilities of a feedthrough.

27047 (PB–89-859284/XAB) **Chemical and biological warfare: detection and warning systems. June 1984-April 1989 (Citations from the NTIS data base). Report for June 1984-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 84p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-863006.

This bibliography contains citations concerning the design and testing of samplers and detectors to provide identification and warning of the presence of chemical and biological agents used in military operations. The sampling techniques are applicable to air and water testing, and to evaluate personnel and equipment exposure. Techniques involve enzyme alarms, chromotography, conductivity meters, spectrophotometry, luminescence, and solid state microsensor devices. Other published searches in this series on chemical warfare cover protection, defoliants, general studies, and biological studies, including chemistry and toxicology. (This updated bibliography contains 114 citations, 15 of which are new entries to the previous edition.)

27048 (SAND–88-2546) **Current shock-isolation system theory and practice for Sandia instrumentation systems at the Nevada Test Site.** Waymire, D.R. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 20p. DOE Contract AC04-76DP00789. Order Number DE89010540/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Most recording and instrumentation systems fielded by Sandia National Laboratories on nuclear weapon effects tests at the Nevada Test Site are shock-isolated to protect them from ground shocks generated by nearby nuclear detonations. In this report, we describe current SNLA shock-isolation practices. Cubic and truncated pyramid foam blocks and Bungee cords/nylon straps are discussed. In addition, calculational methods are presented and examples are given in order to help future experimenters and instrumentation personnel evaluate shock-isolation requirements. 8 refs., 7 figs.

27049 (UCRL–97983) **Microwave pulse generation by photoconductive switching.** Pocha, M.D.; Druce, R.L. Lawrence Livermore National Lab., CA (USA). 14 Mar 1989. 7p. DOE Contract W-7405-ENG-48. (CONF-8805132–15: 4. national conference on high power microwave (HPM) technology for defense applications, Monterey, CA, US, May 9, 1988). Order Number DE89011631/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Laser activated photoconductive semiconductor switching shows significant potential for application in high power microwave generation. Primary advantages of this concept are: small size, light weight, ruggedness, precise timing and phasing by optical control, and the potential for high peak power in short pulses. Several concepts have been suggested for microwave generation using this technology. They generally fall into two categories (1) the frozen wave generator or (2) tuned cavity modulation, both of which require only fast closing switches. We have been exploring a third possibility requiring fast closing and opening switches, that is the direct modulation of the switch at microwave frequencies. Switches have been fabricated at LLNL using neutron irradiated Gallium Arsenide which exhibit response times as short as 50 ps at low voltages. We are in the process of performing high voltage tests. So far, we have been able to generate 2.4 kV pulses with approximately 340 ps response time (FWHM) using approximately a 200μJ optical pulse. Experiments are continuing to increase the voltage and improve the switching efficiency. 3 refs., 6 figs.

45 EXPLOSIONS AND EXPLOSIVES

27050 (AD-A–202758/9/XAB) **United States-Philippines bases agreements: prospect for its renewal. Research report.** Mahimer, S.M. Air War Coll., Maxwell AFB, AL (USA). May 1988. 93p. Available from NTIS, PC A05/MF A01.

Remarks on the problems and issues related to the United States-Philippines Bases Agreement and prospect for its renewal are included namely: analysis of the provisions of the new Philippine Constitution; ASEAN perspective on the bases; US policy on nuclear weapons and its interest and options; Philippine interests and priorities, including alternate plans to compensate for the possible withdrawal of the US from the Philippines; and then an assessment of the effects of these factors on the renewal of the Bases Agreement. There are difficulties and barriers to the renewal of the said Agreement posed by conflicting policies of both parties and also due to divergent views on priorities, constitutional processes of both countries, and time constraints for concluding an agreement. However there are options for the United States regarding the problem, depending upon the desired level of its presence in Asia/Pacific region and how central the Philippine bases are to US national security interests.

27051 (AD-A–202771/2/XAB) **Role of the bomber in integrated air power. Research report.** Lumpkin, P.R. Air War Coll., Maxwell AFB, AL (USA). May 1988. 68p. (AU-AWC–88-161). Available from NTIS, PC A04/MF A01.

The role of bombers and the concept of strategic nuclear deterrence have become dysfunctionally linked. The Air Force fostered this linkage in the post-World War II and Korea era with its reliance on nuclear weapons and strategy of mutually assured destruction. Bombers continue to be a vital component of our nation's strategic nuclear-deterrent forces. However, bombers are not limited to deterring nuclear war. In addition to employing the first nuclear weapons, U.S. war fighting experience shows that bombers have played a crucial role in every major conflict beginning with World War II. Since our experience shows that we have historically employed bombers in a conventional role, the author suggests that we should be prepared to employ them across the spectrum of conflict today. Our experience also clearly shows that bombers have been best employed as an element of integrated air power, rarely as an independent force. Therefore, we should prepare to employ bombers as a member of an integrated air power team. The author also suggests that the concepts of tactical and strategic are ill-defined and serve to divide air power into organizations and forces. The author draws lessons from World War II and Vietnam experiences that could help guide our preparation for future conflicts.

27052 (SAND–88-2800C) **Impact of range safety requirements on electronic S and A [Safe and Arming Device] design.** Dell, D.D.; Medina, A.J. Sandia National Labs., Albuquerque, NM (USA). 12 Apr 1989. 27p. DOE Contract AC04-76DP00789. (CONF-8904157–1: 33. annual meeting of Ammunition Technology Division of the American Defense Preparedness Association, Albuquerque, NM, US, April 12, 1989). Order Number DE89009332/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of a tactical Safe and Arming Device (S and A) as a flight termination system for range safety creates some conflicting requirements on the design of the unit. The purpose for a flight termination system (FTS) is to detonate the weapon under any unforeseen set of circumstances, while the purpose of a tactical S and A Device is to prevent weapon detonation for all but the intended flight profile. With the advent of the all-electronic S and A, the ramifications of the dual requirements on the design of the system should be examined. As viewed from the S and A design vantage point, the issue of range safety is really a reliability issue and not a safety issue. The purpose of the range safety policies is to ensure that the unit used to terminate the flight of a missile will function under any expected or unforeseen set of circumstances which the missile might encounter during its flight. This calls for a flight termination system which must function with ultra-high reliability and with special design features which allow it to operate even under flight environments beyond the tactical requirements. Henceforth, when the issue of range safety is discussed, it will be done so under the guise of the reliability of the flight termination unit, be it the tactical S and A or not.

4501 Chemical

27053 **Smart explosive igniter.** Bickes, R.W. Jr.; Marbach, K.D.; Wilcox, P.D. To Dept. of Energy. USA Patent Application 7-150,805. 1 Feb 1988. 13p. DOE Contract AC04-76DP00789. Order Number DE89010899/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A non electrically conductive substrate includes both an SCB and a semiconductor switch, the switch being electrically connected to cause the SCB to fire when the switch is triggered. 5 figs.

27054 **Ferrite core coupled slapper detonator apparatus and method.** Boberg, R.E.; Lee, R.S.; Weingart, R.C. To Dept. of Energy. USA Patent Application 7-155,439. 12 Feb 1988. 33p. DOE Contract W-7405-ENG-48. Order Number DE89010810/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Method and apparatus are provided for coupling a temporally short electric power pulse from a thick flat-conductor power cable into a thin flat-conductor slapper detonator circuit. A first planner and generally circular loop is formed from an end portion of the power cable. A second planar and generally circular loop, of similar diameter, is formed from all or part of the slapper detonator circuit. The two loops are placed together, within a ferrite housing that provides a ferrite path that magnetically couples the two loops. Slapper detonator parts may be incorporated within the ferrite housing. The ferrite housing may be made vacuum and water-tight, with the addition of a hermetic ceramic seal, and provided with an enclosure for protecting the power cable and parts related thereto. 10 figs.

27055 (UCRL–99492) **The effect of gradients in HMX/TNT content and porosity on shaped charge jet characteristics.** Murphy, M.J. Lawrence Livermore National Lab., CA (USA). 9 Feb 1989. 12p. DOE Contract W-7405-ENG-48. (CONF-890585–2: 11. international symposium on ballistics, Brussels, BE, May 9, 1989). Order Number DE89008043/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sedimentation melt cast explosives are widely used in the loading of charges for research and development as well as for production loading of shaped charges and other explosively driven systems. In particular, Octol is the preferred sedimentation melt cast explosive for development work due to its flexibility of fabrication and high energy density. High energy, precision PBX explosives such as LX-14 are certainly more desirable, however, cost, availability, tooling and machining factors result in the continued use of Octol. Everyone who uses Octol realizes that there is a potential drawback in the HMX/TNT sedimentation melt cast process which results in density gradients in the high explosive. The objective of this paper is to quantify the effects of the density gradients in Octol loaded charge as a function of HMX/TNT content and porosity. 8 refs., 9 figs., 2 tabs.

4502 Nuclear

Refer also to citation(s) 26885, 27048, 27335

27056 (AD-A–203046/8/XAB) **Redesign and rehost of the BIG-STICK nuclear war-game simulation. Master's thesis.** Kalili, R.M. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 98p. (AFIT/GCS/ENG–88D-12). Available from NTIS, PC A05/MF A01.

The strategic nuclear wargame BIG STICK is a two-sided, interactive, computer simulation used by the Air Command and Staff College to assist students in learning about real-world nuclear war planning. Currently, the simulation is played on the Honeywell H6000 mainframe. Shortcomings of the simulation are the user-hostile environment, a rigid input format. The unforgiving and inflexible user interface, and the fixed file system that makes data changes and program enhancements difficult. The purpose of this thesis effort was to redesign and rehost the BIG STICK simulation to the Zenith Z-158 classroom microcomputers. Game sites, fixed and controlled force assets, expected value probabilities, and exercise constraints are now stored in a relational data base designed using the entity-relationship (E-R) model. The user interface was redesigned using general user-friendly program principles and guidelines to provide a screen-oriented environment for students to enter force selection, deployment, targeting, and employment inputs. Reports reflecting the results of student inputs were designed

and developed as part of the interface using the PC INGRESS data-base-management system. The actual game-play portion of the simulation was designed using top-down, hierarchical decomposition. Implementation of the design into program code is not included in the scope of this thesis.

27057 (DOE/EH–0081) **Technical Safety Appraisal of the Rocky Flats Plant.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Jan 1989. 301p. Order Number DE89010653/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

This report provides the results of a Technical Safety Appraisal (TSA) of the Rocky Flats Plant (RFP) conducted November 14 to 18 and November 28 to December 9, 1988. This appraisal covered the effectiveness and improvements in the RFP safety program across the site, evaluating progress to date against standards of accepted practice. The appraisal included coverage of the timeliness and effectiveness of actions taken in response to the recommendations/concerns in three previous Technical Safety Appraisals (TSAs) of RFP Bldg. 707 conducted in July 1986, Bldgs. 771/774 conducted in October/November 1986, and Bldgs. 776/777 conducted in January/February 1988. Results of this appraisal are given in Section IV for each of 14 technical safety areas at RFP. These results include a discussion, conclusions and any new safety concerns for each technical safety area. Appendix A contains a description of the system for categorizing concerns, and the concerns are tabulated in Appendix B. Appendix C reports on the evaluation of the contractor's actions and the current status of each of the 230 recommendations and concerns contained in the three previous TSA reports.

27058 (SAND–88-2442C) **A unidirectional rotary solenoid as applied to stronglinks.** Kenderdine, E.W. Sandia National Labs., Albuquerque, NM (USA). 1988. 21p. DOE Contract AC04-76DP00789. (CONF-890571–2: 23. aerospace mechanisms symposium, Huntsville, AL, US, May 3, 1989). Order Number DE89005233/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the design goals and results of an advanced development stronglink project with special emphasis on a new rotary solenoid concept. 10 figs.

27059 (UCID–21551) **An inventory of wargaming models for special warfare: Candidate applications for the infusion of human performance data.** Burton, H.D.; Banks, W.W.; Schultz, E.E.; Berghage, T.E. Lawrence Livermore National Lab., CA (USA). 1 Nov 1988. 283p. DOE Contract W-7405-ENG-48. Order Number DE89006801/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The material contained in this compendium has been drawn from many sources in an attempt to define the number and types of small group combat simulation models which currently exist. The emphasis placed on this particular effort was to identify combat simulation models which are oriented or could be oriented toward special warfare involving highly trained, light, mobile forces. These descriptions and characterizations of the different simulation models should be viewed with the goal of infusing human performance data and human performance models into candidate simulation models to enhance both fidelity and realism. We feel that this listing will be of direct benefit to military and civilian scientists who are interested in identifying candidate combat simulation models which can be targeted for enhancement with appropriate human performance data. Few existing models reviewed were found to incorporate laboratory or field data drawn from the behavioral sciences or human performance literature. Several models did incorporate human performance assumptions which were found to be incongruent with real world data about how people behave under various environmental conditions and both physical and cognitive stress.

4503 Explosion Detection

27060 (UCID–21599) **Depth estimation of seismic sources with small networks.** Dowla, F.U. Lawrence Livermore National Lab., CA (USA). 13 Dec 1988. 17p. DOE Contract W-7405-ENG-48. Order Number DE89011336/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Since hypocenters of earthquakes are usually deeper than those of explosions, depth of focus measurement could be a valuable source discrimination parameter for test ban treaty verification. In this paper, we study the problem of determining depth of underground sources using a small planar network. By deriving analytical results and by verifying these results with computer simulation of seismic networks, we show that in terms of estimating source depths accurately, performance of a network can be improved using an appropriate distribution of stations. While it is desirable to place the stations close to the source, there might be physical limitations to this strategy in a verification scenario. We have shown for a given closest station-source radial distance, it is desirable to place some of the other stations about twice as far as this distance, from the source, for better depth estimation. Furthermore, a distribution of stations which results in a set of source-receiver distances which are all different from each other is desirable for accurate depth estimation of shallow sources. 10 refs., 6 figs.

27061 (UCRL–21162) **Monitoring electromagnetic emissions from underground nuclear tests: Final report, January 13–September 30, 1988.** Sentman, D.D. Lawrence Livermore National Lab., CA (USA). Sep 1988. 35p. DOE Contract W-7405-ENG-48. Order Number DE89010785/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the reporting period UCLA fielded two stations at the Nevada Test Site, at Area 8 and Frenchman Flat, respectively, and monitored three underground tests. Measurements were made of the vertical electric field and the two orthogonal horizontal components of the magnetic field in the frequency passband 3–60 Hz. The tests that were monitored were: Shellbourne, May 13, 1988; Comstock, June 2, 1988; and Kearsarge, August 17, 1988. Signals were observed from the Shellbourne test, but none were observed from the Comstock or Kearsarge tests. The details of the observations made during these tests were submitted to LLNL shortly after the tests were performed. Copies of these reports are included herewith.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

27062 (KTM/E-D–162) **Total emission from energy production in Finland.** Hupa, M.; Bostroem, S.; Nermes, M. Kauppa-ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. Dec 1988. 73p. (In Finnish). Order Number DE88757297/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The report presents estimates of flu gas emissions from energy production in Finland, covering sulphur oxides, nitrogen oxides particulate matter, trace metals (As, Cr, Ni, V, Pb, Cd, Hg) and combustible gases (CO, CxHy, PAH). The estimates are based on a model describing the fuel distribution among different boiler types in Finland and on official statistics on the total consumption of fuels in Finland. The estimated concern the year of 1987. The total emission of sulphur dioxides was approx. 240 000 t SO2, and of nitrogen oxides 107 000 t NO2. The main sources are large coal fired boilers, mixed fuel boilers and industrial processes. The emission of particulate matter was approx. 60 000 t, the main sources beeing combustion in small furnaces (<1 MW) and recovery boilers. Rough estimates of the trace metal emissions are presented as well as information on main emission sources for each metal. The total emission of carbon monoxide was roughly 130 000t CO, two thirds of which comes from small furnaces. The estimate of hydrocarbon emissions is uncertain. However, 90% of the hydrocarbon emission, and even more of the PAH emission, can be estimated to origin in combustion of wood in small furnaces.

27063 (NEI-DK–145) **International review of Danish environmental research.** Planlaegningsraadet for Forskningen, Copenhagen (Denmark). 1989. 228p. (In English, Danish). Order Number DE88757307/JAW. Available from NTIS (US Sales Only), PC A11/MF A01.

A general review of the national science and technology policy of Denmark was carried out by OECD in 1987. Recently, in response to concerns expressed by the Danish government, the Council for Research Policy and Planning has developed and initiated a major review of the current status and future plans for Danish research on environmental problems. Specifically, this review was designed to meet the government request for an evaluation of the standard of Danish research on environmental problems as well as its relevance, its coherence and the utilization of its results. This review was conducted by researchers drawn from the international scientific community, organized into five panels: air, water, soil and ground water, ecosystems, and human health. The review was conducted during the period from 8 January to 15 January 1989. Visits were made to most major laboratories conducting research on environmental issues in Denmark, and the work presented by leading investigators was discussed. Each panel report contains comments on the scientific and technical resources of individual institutions. The present document draws on and integrates the conclusions of the panels. (SM).

5002 Chemicals Monitoring and Transport

Refer also to citation(s) 26246, 26247, 26249, 26476, 26477, 26607, 26608, 26610, 26626, 26864, 27041, 27149, 27150, 27152, 27156, 27324, 27325, 27326

27064 (AD-A–202485/9/XAB) **Comparative inhalation screen of titanium dioxide and graphite dusts. Technical report, September 1987-June 1988.** Thomson, S.A.; Bergmann, J.D.; Burnett, D.C.; Carpin, J.C.; Crouse, C.L. Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD (USA). Nov 1988. 224p. (CRDEC-TR–88161). Available from NTIS, PC A10/MF A01.

Occupational exposure to airborne graphite may occur in manufacturing and application processes. Synthetic graphite is a pure crystalline form of carbon produced from high-temperature treatment of petroleum products and contains less than 1% quartz; it is considered a nuisance dust by the American Conference of Governmental Industrial Hygienists. Natural graphite is the mineral form of graphitic carbon and contains associated silicate minerals. Titanium dioxide is also regarded as a nuisance dust and was used as a negative control in this study. Fischer 344 rats were exposed via whole body inhalation to 100 mg/cu. m of synthetic graphite, natural graphite, and titanium dioxide for 4 hr/day for 4 days. At 24 hr and 14 days post-exposure (PE), exposed and air-exposed controls were evaluated for bronchoalveolar lavage (BAL), physiological, and pathological changes. BAL changes were the most-sensitive indicator of damage; although the enzymatic and cytological alterations were evident with all three materials, there were greater increases with the graphite dusts. By 14 days PE, all BAL changes were resolved. There appears to be no deleterious tissue reaction to any of the materials at the levels tested in this study.

27065 (AD-A–203133/4/XAB) **Clusters: elucidating gas-to-particle conversion processes.** Castleman, A.W. Pennsylvania State Univ., University Park, PA (USA). Dept. of Chemistry. 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Environmental Science and Technology, Vol. 22, No. 11, 1265-1267(1988).

Why is there currently so much interest in the subject of fine particles. First, fine particles are ubiquitous throughout the universe: They are present in interstellar media (e.g., in dense clouds as well as comets); they are ultimately responsible for the rings around Saturn, and, in some theories of planetary evolution, they are invoked to explain the origin of planets themselves. In high altitudes of our own planet there are layers of meteoritic ablation where dust layers are known and noctilucent clouds form, possibly enhanced by ion-induced nucleation processes. For more down-to-earth reasons, fine particles are of interest to environmental scientists, who must contend with them in ways more germane to our everyday life in terms of visibility and health.

27066 (BCMEP–1987) **A preliminary report on volatile organic compound emissions from gasoline marketing in the lower mainland.** Wituschek, E.P.; Bhattacharyya, K.K. British Columbia Ministry of Environment and Parks, Victoria (Canada). 1987. 22p. (MICROLOG–89-01032). Available from British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report reviews volatile organic emissions from gasoline marketing in the Lower Mainland of British Columbia with the view to identify potential emission reduction options. Successively considered are: bulk terminals, bulk plants, tank trucks, service stations and vehicle refuelling. The incidence of volatile organic compounds (VOC) on the ozone layer is discussed, as well as possible strategies to reduce the emmission of VOCs (estimated at 5,800 ton/y for Vancouver only), recommendations are made in this respect. 1 fig., 1 tab.

27067 (BNL–52194) **Field performance testing of a Free-Air Controlled Enrichment (FACE) system for the regulation of carbon dioxide concentrations in a cotton field at Yazoo City, Mississippi.** Hendrey, G.R.; Lewin, K.F.; Kolber, Z.; Kolber, D.; Lipfert, F.W.; Daum, M. Brookhaven National Lab., Upton, NY (USA). Dec 1988. 50p. DOE Contract AC02-76CH00016. Order Number DE89010273/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A Free-Air Carbon dioxide Enrichment (FACE) array was assembled in a cotton field at Yazoo City, MS, in the summer of 1987 to develop and evaluate control of CO_2 concentrations over extended periods in an agricultural setting. A variety of system configurations was tested in 17 case-runs, at CO_2 concentration set points of 500, 600 and 700 ppM. Reliable data were obtained from 532 hours out of 602 hours of operation. In general, a better degree of control was obtained at the 500 and 600 ppM set points than at 700 ppM. In the worst case, 1-second observations differed by more than 20% of the 700 ppM set point for no more than 17% of the time. In the best case, 1-sec CO_2 concentration was 20% or more away from the 500 ppM set point for no more than 6% of the time. The coefficients of variation for daytime measurements at a 600 ppM set point were 0.16, 0.07, 0.03, and 0.02, for 1-second, 5-minute, 30-minute and 1-hour aggregations, respectively, indicating the effect of data aggregation on perceived performance. Over all, the FACE system greatly exceeded performance criteria. Analysis and discussion of factors influencing system performance are presented. Field site selection and layout, advantages and disadvantages of the Yazoo City field site, and the physical FACE system and its control equipment and software are described. 6 refs., 16 figs., 7 tabs.

27068 (ECN–89-052) **The influence of manganese on the oxidation of sulfite in dew water.** Arends, B.G.; Eenkhoorn, S. Netherlands Energy Research Foundation, Petten (Netherlands). Apr 1989. 9p. Available from Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Paper presented at the workshop 'Mechanismus und Wirkung des Schadstoffeintrages in Waldgebieten', Oberursel, F.R. Germany, 24-25 November 1988.

High concentrations of manganese were found in dew water on grass which are believed to be catalytically active in the oxidation of sulfite. In order to describe this oxidation the reaction was studied in a fog chamber. In the concentration and pH range, normally found in dew on grass, the formation of sulfate is linearly dependent on the concentration of manganese and on the square root of the concentration of sulfite. The results indicate that the manganese catalysed sulfite oxidation is an important reaction in dew on grass. 2 figs., 8 refs., 3 tabs.

27069 (ECN–89-060) **Determination of HNO_3 and NH_4NO_3 in ambient air by a denuder/filter pack, a thermodenuder and a wet annular denuder.** Keuken, M.P.; Wayers-IJpelaan, A.; Otjes, R. Netherlands Energy Research Foundation, Petten (Netherlands). Apr 1989. 15p. Available from Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

During an intercomparison experiment for the measurement of HNO_3 and nitrate-containing aerosols in ambient air at Rome, ECN participated with a denuder/filter pack combination, a thermodenuder and a wet annular denuder. The annular denuder/filter pack configuration is based on a NaF-coated denuder, followed by a PTFE filter an a NaF-coated paper filter. After sampling the denuder

and filters are extracted with water and the solutions are analyzed by ion chromatography for nitrate. At a sample flow of 5 $l.min^{-1}$ and a sampling time of 4 hours the limit of detection of both HNO_3 and NH_4NO_3 is 0.1 $microg.m^{-3}$. The automated annular themodenuder is based on sampling of HNO_3 and NH_4NO_3 by a $MgSO_4$-coating at ambient temperature and 140 C, respectively. After a sampling time of 30 minutes at a flow rate of 5 $l.min^{-1}$ the collected components are thermally desorbed at 700 C and the liberated NO_x is detected by a NO_x monitor. The detection limit of HNO_3 and NH_4NO_3 is 0.1 $microg.m^{-3}$. The automated wet annular denuder is based on sampling of HNO_3 with an aqueous solution present in the annulus of the rotating denuder. After a sampling time of 35 minutes at a flow rate of 30 $l.min^{-1}$, automatically the absorption solution is pumped into a sample tube and the denuder is recoated. The obtained solutions are analyzed for NO_3^- by off-line ion chromatography. The detection limit of HNO_3 is 0.1 $microg.m^{-3}$. For the measurement of HNO_3 these techniques show good agreement with the data obtained by the other participants of the experiment. The results for NO_3^--containing aerosols obtained by the thermodenuder are significantly lower than the average values from the other participants. It is suggested that this is caused by a malfunction of the thermodenuder. 7 figs., 4 refs.

27070 (EGG-M-89011) **Monitoring concepts useful in the assessment of climate change effects on US fish and wildlife resources.** Breckenridge, R.P.; Otis, M.D. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 6p. DOE Contract AC07-76ID01570. (CONF-881218-2: 2. North American conference on preparing for climate change, Washington, DC, US, December 6, 1988). Order Number DE89009747/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objectives of this paper are to: (1) discuss the sensitivity of fish and wildlife resources and their habitats to climate changes as a basis for selecting indicators of climate change effects; (2) outline an anticipatory monitoring approach for trend assessment; and (3) identify regional and national challenges for management response to affected wildlife resources. It is important to note the fundamental differences between measuring meteorological and atmospheric parameters for the presence of global climatic changes and monitoring for their influence on a particular ecosystem. Measuring meteorological and atmospheric parameters of climate change is a relatively well defined problem that is based on three important elements: changes can be measured using existing techniques for observing standard meteorological parameters, data describing meteorological conditions are available in many cases in enough detail to develop baselines for the evaluation of trends, and global climate and circulation models, while limited in many respects, provide a solid conceptual framework that is capable of generating testable hypotheses about the direction and magnitude of anticipated changes. 9 refs.

27071 (EPRI-EN-6204) **Human activity patterns in Cincinnati, Ohio: Final report.** Johnson, T. Electric Power Research Inst., Palo Alto, CA (USA); PEI Associates, Inc., Durham, NC (USA). Apr 1989. 267p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Under direction of the Electric Power Research Institute, PEI Associates conducted a study of human activity patterns in a three-county area which included Cincinnati, Ohio. The primary objective of this study was to develop a large data base containing typical 24-hour activity patterns for both urban and rural population groups which could be used to estimate human exposure to air pollution. A total of 973 study participants were obtained through the use of a screening questionnaire administered to several thousand households in the study area. Each participant was asked to carry an activity diary for three consecutive 24-hour sampling periods in either March or August of 1985. Each participant was also requested to complete a detailed background questionnaire. The questionnaire responses and approximately 2800 subject-days of activity diary data were collected, validated, and entered into an activity-pattern data base that can be used by existing models to estimate the seasonal exposure of specific population subgroups to air pollution. A special graphics program was developed to display the hour-by-hour probability of a user-defined event occurring to a member of a specific subgroup. 2 refs., 13 figs., 22 tabs.

27072 (NEI-DK-135) **Oxygen control in solid fuel fired heating systems with zirconium oxide cells.** Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik. Zielke, U. Jysk Teknologisk, Aarhus (Denmark). Oct 1988. 31p. (In Danish). Order Number DE88757299/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik.; EFP-87.

During the heating season 87-88 the Jutland Technological Institute has carried out investigations of the zirconium oxygen meters of solid fuel heating units. The aim was to investigate whether the combustion of inflammable flue gas components on the surface of the oxygen meter cell is of any importance to the running and emissions of the units. The used zirconium oxide oxygen meters normally measure lower concentrations of oxygen as the paramagnetic comparator of the laboratory. The relative deviation is lowest at coal fired units (5.5% and highest at straw fired units (20%)). At several units there is a clear tendency towards increasing development of CO at an increasing surplus of air. Because of too large a surplus of air, and in consequence of this the formation of CO, the chimney waste of the units is increased by up to 6%. Both the surplus of air and the concentration of CO have been included as long term average values. Especially at the straw fired units, periodically very high concentrations of non-inflammable flue gas components can be found, resulting in an undesirable influence on the environment. The development of improved control systems and regulation equipment is recommended.

27073 (NEI-DK-141) **Determination of sulphur dioxide and nitrogen oxide concentration in flue gas.** Colliander, B.; Moeller, H.; Nielsen, P.R. Danske Elvaerkers Forening, Copenhagen (Denmark). Kraftvaerkernes Miljoeudvalg, Stoev- og Roeggasgruppen. May 1988. 120p. (In Danish). Order Number DE88757303/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

The aim was to investigate the reliability of measurements of sulfur dioxide and nitrogen oxide concentration in flue gas and of the efficiency of three emission monitoring instruments used in Danish power plants. Measuring methods are also examined. The following analysators were tested for accuracy: KMU-ref., Radas, SO2 (UV-abs), KMU-ref., AAL, NO (Kemilum), Lear Siegler, NO/NO2 (UV-diff.abs), Codel, NO (IR-GFC), and Syconex, SO2 (IR-GFC). (AB).

27074 (NEI-NO-80) **Reduction of SO_2 and NO_x effluents in alternative ways of meeting the energy demand.** Borring, J.; Fuglestvedt, J.; Kristiansen, A. Oslo Univ. (Norway). Raadet for Natur- og Miljoefag. Apr 1987. 52p. (In Norwegian). Order Number DE88757316/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

In various energy scenarios is discussed how to reduce the effluents of SO_2 and NO_x to air from the use of oil for heating purposes. The basis is the prognosis numbers in a report to the Storting (Parliament) on "Norway's future energy use and production", and demonstrated possibilities for alternative ways of meeting the energy demand by means of gas, biomass, energy conservation, heat pumps and solar energy. These alternatives may be used to substitute different parts of the oil consumption and the corresponding size of the effluent reduction is shown. In addition, the socio-economic energy costs associated with the various scenarios are calculated. The alternative plans of meeting the energy demand are valid for the 1993, and the calculations of effluents and costs are also valid for that year. 15 refs., 8 figs., 3 tabs.

27075 (NILU-OR-35/88) **Measurements of photochemical oxidants (ozone and PAN) in Norway 1986.** Hoem, K.; Dreiem, R.; Krognes, T.; Schjoldager, J.; Stige, L.; Tveita, B. Norsk Inst. for Luftforskning, Lillestroem (Norway). Jan 1988. 95p. (In Norwegian). Order Number DE88757317/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Ozone measurements were carried out at nine sites in Norway during the summer of 1986. Hourly concentrations exceeded 200 png/m^3 at two sites. The highest one-hour peroxyacetyl nitrate (PAN) concentration was 15 png/m^3. 6 refs., 4 figs., 7 tabs.

27076 **Inertial impaction air sampling device.** Dewhurst, K.H. To Dept. of Energy. USA Patent Application 7-130,926. 10 Dec

1987. 18p. DOE Contract AC04-76DP00789. Order Number DE89010962/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An inertial impactor to be used in an air sampling device for collection of respirable size particles in ambient air which may include a graphite furnace as the impaction substrate in a small-size, portable, direct analysis structure that gives immediate results and is totally self-contained allowing for remote and/or personal sampling. The graphite furnace collects suspended particles transported through the housing by means of the air flow system, and these particles may be analyzed for elements, quantitatively and qualitatively, by atomic absorption spectrophotometry. 3 figs.

27077 (PB–89-143226/XAB) **Health hazard evaluation determination report No. HHE-78-114-572, Gardner-Denver Company, Commerce City, Colorado.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1979. 12p. (HHE–78-114-572). Available from NTIS, PC A03/MF A01.

Air samples were analyzed for toxic concentrations of oil-mist, iron-oxide, 1,1,1-trichloroethane, and nitrite, at the Gardner-Denver Company, Commerce City, Colorado, on October 17 and 18, 1978. A representative of the United Steelworkers of America requested the evaluation on behalf of the approximately 200 affected employees. Oil-mist concentrations in the drop-forge work area exceeded the current OSHA standard of 5 milligrams per cubic meter. All other worker exposures were well within evaluation criteria for other potentially toxic substances. The author recommends that appropriate respirators be used, that hygienic eating places for workers be provided, that auditory protective equipment be used among workers in the drop-forge area, and that local exhaust ventilation be stalled in the drop-forge area.

27078 (PB–89-143234/XAB) **Health-hazard evaluation report No. HHE-78-092-571, Northpark Millwork Ltd., Colorado Springs, Colorado.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1979. 17p. (HHE–78-092-571). Available from NTIS, PC A03/MF A01.

Environmental air samples were analyzed for toxic concentrations of wood dust, 1,1,1-trichloroethane, and other chemical constituents of lacquer thinner at the Northpark Millwork LTD, Colorado Springs, Colorado on August 28 and 29, 1978. The evaluation request was made from an authorized representative of approximately 15 affected employees. Four of six samples for wood dust exceeded the evaluation criteria of 5 milligrams per cubic meter, while the average wood-dust concentration was more than double the evaluation criteria. Although none of the samples for the Lacquer thinner vapors exceeded the evaluation criteria, the author concludes that the cabinet makers were exposed to potentially toxic concentrations of 1,1,1-trichloroethane and other lacquer thinner constituents. Employees who worked with stationary power woodworking equipment were exposed to potentially toxic concentrations of wood dust. Monitoring wood-dust concentrations, various exhaust ventilation modifications, and the use of respirators by appropriate workers, and other safety measures are recommended.

27079 (PB–89-143242/XAB) **Health-hazard evaluation determination report No. HHE-78-104-565, Universal Printing Company, St. Louis, Missouri.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Feb 1979. 22p. (HHE–78-104-565). Available from NTIS, PC A03/MF A01.

The workplace was inspected, employees participated in medical interviews and limited physical examinations, and personal air samples were taken to determine exposure concentrations at a facility (No. 2) of the Universal Printing Company in St. Louis, MO, on July 18-20, 1978. Samples were analyzed by gas chromatography for total naphtha, toluene, ethyl benzene, m-xylene, cumene, 1,3,5-trimethyl benzene, and 1,2,4-trimethyl benzene. Of the approximately 30 employees, 40% of the employees complained of hand and arm irritation and approximately one-third of all employees reported seldom wearing or having impervious gloves available. Two cases of eye irritation were found with two other reports of previous eye irritation. Splash goggles were not available in the shop. Approximately 40% complained of occasional dizziness during blanket washing. The investigators conclude that, although employee exposure to airborne contaminants was not found to be toxic at the time of testing, exposure could be potentially toxic if employees worked overtime or did more cleanup or changeover operations than they did at the time of testing. The investigators recommend that numerous safety practices be instituted.

27080 (PB–89-143341/XAB) **Health-hazard evaluation determination report No. HHE-78-025-488, Wheeling Pittsburgh Steel Corporation, Yorkville, Ohio.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1978. 10p. (HHE–78-025-488). Available from NTIS, PC A02/MF A01.

A health-hazard evaluation to determine possible hazardous exposure to monoethanolamine (MEA) and carbon monoxide (CO) through leakage at Wheeling Pittsburgh Steel Corporation, Yorkville, Ohio was made. The plant is involved in treating and finishing steel produced in other facilities. The study was requested after sore throat complaints from workers in the HNX area where carbon monoxide is oxidized to carbon dioxide and removed using an MEA solution. MEA and CO samples were collected. Employees were interviewed regarding work histories and health problems. Sixteen of 18 atmospheric samples of MEA were below the limits of detection by current techniques. The remaining two breathing-zone samples of HNX operators were 2.1 and 1.0. Such exposure might contribute to frequent sore throat complaints in employees. CO samples were below the recommended 8-hour time-weighted average environmental limits. MEA exposure is a possible contributor to frequent sore throats among workers. Drying up standing MEA puddles; cleaning the substance from pipes and machinery; and reducing leakage were recommended.

27081 (PB–89-144695/XAB) **National Crop Loss Assessment Network: quality assurance program (journal version).** Coffey, D.S.; Sprenger, J.C.; Tingey, D.T.; Neely, G.E.; McCarty, J.C. Northrop Services, Inc., Corvallis, OR (USA). 1988. 13p. Available from NTIS, PC A03/MF A01.

Pub. in Environmental Pollution, Vol. 53, 89-98(1988). See also PB–88-180724.

A quality assurance program was incorporated into the National Crop Loss Assessment Network (NCLAN) program, designed to assess the economic impacts of gaseous air pollutants on major agricultural crops in the United States. The quality assurance program developed standardized research and monitoring protocols among sites, and included a range of audit and review procedures. The goal was to quantitatively describe the overall quality of data collected in terms of precision, accuracy, completeness, representativeness, and comparability. Project data quality objectives were valuable for determining the acceptability of data from diverse sites. Standardized protocols ensured data comparability among research sites. Independent on-site audits served to evaluate protocol adherence, and precision and accuracy measurements provided a way to assess data quality, determine data acceptability, and indicate the need for instrument adjustment or repair.

27082 (PB–89-145460/XAB) **Health-hazard evaluation report HETA 82-195-1200, US Secret Service, Washington, DC.** Lee, S.A. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1982. 15p. (HETA–82-195-1200). Available from NTIS, PC A03/MF A01.

The possible health hazards to United States Secret Service officers of exposure to airborne lead during the use of an indoor firing range, Washington, D.C., and Beltsville, Maryland were investigated. The Safety Division of the Department of Treasury requested the study which was performed on May 5, 1982. Four shooters at the Beltsville Range were exposed to an 8-hour-average (TWA) lead concentration of 38 micrograms per cubic meter (microg/m^3). During a 25-minute period they were exposed to a mean concentration of 720microg/m^3. Two shooters at the Washington range were exposed to concentrations of lead ranging from nondetectable to 18microg/m^3. One shooter was exposed to a copper TWA of 33.6microg/m^3. The author concludes that a potential hazard from overexposure to lead did exist. However, the officers would rarely shoot on a daily basis, and ventilation design appeared adequate for normal use. Recommendations for limiting the use of lead bullets and improving ventilation are provided.

27083 (PB–89-145478/XAB) **Walk-through survey of General Electric Company, Hudson Falls, New York, and Fort Edward,**

New York, January 20, 1976. Jones, M. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies. 27 Apr 1976. 8p. (IWS–095.12A). Available from NTIS, PC A02/MF A01.

Walk-through surveys were conducted at the General Electric facilities in Hudson Falls and Ft. Edward, New York with particular interest in workers exposed to polychlorinated biphenyls. The process of manufacturing capacitors filled with dielectric fluid (mainly polychlorinated biphenyls) is described. Potential hazards also include lead, trichloroethylene, and noise exposure in processing operations. Industrial hygiene and safety practices are briefly discussed. A recommendation is made to do industrial-hygiene sampling at the plants.

27084 (PB–89-145536/XAB) **Health hazard evaluation determination report No. HHE-75-196-290, Bruce W. Weatherwax, D.D.S., Torrington, Wyoming.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1976. 7p. (HHE–75-196-290). Available from NTIS, PC A02/MF A01.

A health-hazard evaluation of the room air samples for inorganic mercury conducted in the Bruce W. Weatherwax Dental Clinic in Torrington, Wyoming, shows that the concentrations of mercury during the evaluation are below the NIOSH detection limit of 0.2 micrograms. The NIOSH recommended standard is 0.05 milligrams per cubic meter. A health hazard is not judged to exist at the time of evaluation. Recommendations include use of tightly closed capsules during amalgamation, salvaging all amalgam scraps and storing in a closed container with a layer of water over the amalgam; storing of mercury in an unbreakable, tightly sealed container; and, cleaning up of all mercury spills immediately, preferably by vacuuming. Sweeping has to be avoided because it creates dust and breaks the mercury into even smaller particles that can vaporize more quickly.

27085 (PB–89-145593/XAB) **Health-hazard evaluation determination report No. 78-47-570, American Concrete Division, Union Metal Company, Waukegan, Illinois.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1979. 14p. (HHE–78-047-570). Available from NTIS, PC A03/MF A01.

Personal breathing-zone and general-area air samples were taken to determine worker exposures to toluene, mineral spirits, naphtha, methyl-isobutyl ketone, iron oxide, fumes, chromium, nickel, copper, aluminum, total particulates, respirable particulates and respirable free silica at American Concrete Division, Union Metal Company in Waukegan, Illinois on March 30, July 5 and October 20, 1978. Three of 8 personal air samples taken in the mixing area exceeded the evaluation criteria for crystalline silica of 0.05 milligrams per cubic meter. All the other substances measured were well below the evaluation criteria. The authors conclude that the concentration of respirable-free silica constitutes a health hazard to workers. They recommend engineering and administrative controls to reduce airborne chemical concentrations, the use of respirators, and the enclosure of mold spinning machines.

27086 (PB–89-145627/XAB) **Health-hazard evaluation determination report No. HHE-78-074-575, Interlake Steel, Inc., Wilder, Kentucky.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1979. 12p. (HHE–78-074-575). Available from NTIS, PC A03/MF A01.

Environmental and personal air samples were analyzed for manganese, calcium oxide, iron oxide, and total particulates at Interlake Steel, Inc., Wilder, Kentucky, on August 30 and 31, 1978. Manganese air concentrations were below the OSHA standard of 5.0 milligrams per cubic meter (mg/CuM). Calcium oxide concentrations ranged from 0.04 to 72.0mg/CuM, compared with the American Conference of Governmental Industrial Hygienist's (ACGIH) recommended standard of 2.0mg/CuM. Iron oxide concentrations ranged from 0.10 to 5.10mg/CuM, compared with the ACGIH recommended standard of 5.0mg/CuM. Total particulates ranged from 0.37 to 31.8mg/CuM compared with the ACGIH standard of 10.0mg/CuM. The author concludes that the bulldozer operator was exposed to excessive concentrations of calcium oxide, and nuisance particulate, and the tractor operator was exposed to excessive concentrations of calcium oxide, iron-oxide, and particulate. Recommendations include yearly chest x rays for workers in dusty environments, the use of personal protective equipment, and improved industrial hygiene.

27087 (PB–89-145965/XAB) **Ozone trends within a large metropolitan area: the Los Angeles basin.** McGuire, T. California State Air Resources Board, Sacramento, CA (USA). Technical Support Div. May 1988. 20p. (ARB/TSD–88-008). Available from NTIS, PC A03/MF A01.

See also PB–89-145957.

This paper reviews trends in ambient ozone concentrations in the Los Angeles Basin from 1955. Most emphasis is placed on data acquired since 1973. Temperature adjustment is used as a tool to reduce year-to-year ozone fluctuations. Trends of emissions of hydrocarbons and nitrogen oxides are also examined. In general, the trend in ambient ozone concentrations have been improving, but some periods during the record and some locations in the basin have experienced increases. Decided differences in ozone concentrations and trends are evident for different geographic parts of the basin.

27088 (PB–89-148274/XAB) **Reduction of volatile organic compound emissions from the application of traffic markings. Final report.** Aurand, G.A.; Turner, M.B.; Athey, C.J.; Neulicht, R.M. Midwest Research Inst., Cary, NC (USA). Aug 1988. 53p. Available from NTIS, PC A04/MF A01.

See also PB–89-148282.

Traditional traffic marking materials (solvent-borne paints) are a source of volatile organic compound (VOC) emissions. The study was conducted to evaluate alternative traffic-marking techniques that can be used to reduce VOC emissions from this source. This document provides information on traffic marking application processes, VOC emissions and emission reductions, and costs associated with the alternative marking techniques. The primary conclusions from the study are: (1) the use of available low-and zero-VOC alternatives can result in VOC emission reductions ranging from 15% to 100%; (2) the annualized costs for the alternative marking techniques are less than or equivalent to those for traditional solvent-borne paints; and (3) the performance of the alternative markings is equivalent to or better than that of traditional solvent-borne paints.

27089 (PB–89-148282/XAB) **Reduction of volatile organic compound emissions from automobile refinishing.** Athey, C.; Hester, C.; McLaughlin, M.; Neulicht, R.M.; Turner, M.B. Midwest Research Inst., Cary, NC (USA). Oct 1988. 98p. Available from NTIS, PC A05/MF A01.

See also PB–89-148274.

Automobile refinishing (repainting) is a source of volatile organic compound (VOC) emissions. The study was conducted to evaluate available techniques that can be used to reduce VOC emissions from this source. The document provides information on the steps involved in the refinishing process which result in emissions, available emission reduction techniques, VOC emission levels, VOC emission reductions, and costs associated with the reduction techniques. Techniques investigated include (1) reduced-VOC cleaners, (2) replacement of lacquers with enamels, (3) replacement of enamels with polyurethanes, (4) replacement of solvent-borne primers with waterborne primers, (5) replacement of conventional clearcoats with higher-solids clearcoats, (6) installation of cleanup solvent recovery systems, (7) replacement of conventional spray guns with higher transfer efficiency equipment, and (8) add-on controls. The primary conclusions from the study are: (1) the use of available techniques could result in VOC emission reductions ranging from 3-50% of the current estimated baseline emissions from typical refinishing shops; and (2) the annualized costs for many of the available techniques are less than the cost of current practices.

27090 (PB–89-148597/XAB) **Mountain Cloud Chemistry Project: wet, dry, and cloud water deposition.** Mohnen, V.A. State Univ. of New York, Albany, NY (USA). Atmospheric Sciences Research Center. Jan 1989. 87p. Available from NTIS, PC A05/MF A01.

This report is the second in a series of annual summaries of research on the deposition of airborne chemicals to forest canopies and the forest floor in eastern North America. The report is based on observations and model estimates of atmospheric deposition at high-elevation sites in the eastern United States. The report is produced by the scientists in the Mountain Cloud Chemistry Program.

One of the major objectives of the research is to characterize regional (mainly longitudinal) and elevational variability in the amounts of airborne chemicals transferred from the atmosphere into the spruce-fir and other forest ecosystems that cover high-elevation sites in the Appalachian Mountains of the eastern part of North America.

27091 (PB–89-151526/XAB) **Exposure of forests to air pollutants, clouds, precipitation, and climatic variables.** Mohnen, V.A. State Univ. of New York, Albany, NY (USA). Atmospheric Sciences Research Center. Jan 1989. 209p. Available from NTIS, PC A10/MF A01.

ThIS report contains atmospheric measurements data at high-elevation sites in the eastern United States. Measurements made in 1987 from May to October are included for O_3, SO_2, NO_2, cloud water content, cloud chemistry, H_2O_2. Historical data from other sites are included for comparison purposes as well as data on climatic variables. Sites at Mt. Mitchell, NC, Shenandoah, VA, Whitetop, VA, Whiteface Mt., NY, Mt. Moositauke, NH, and Howland, Maine form the Mountain Cloud Chemistry Project (MCCP). The primary objective of the MCCP is to characterize the exposure of montane forested ecosystems to atmospheric inputs. The high-elevation forests of the eastern United States are of particular interest because of reported declines in the populations of red spruce and balsam fir trees at selected locations throughout the Appalachian Mountains.

27092 (PB–89-151534/XAB) **Sampling and analysis of butadiene at a synthetic rubber plant.** Goodrich, J.D.; DeWees, W.G.; Segall, R.R. Entropy Environmentalists, Inc., Research Triangle Park, NC (USA). Jan 1989. 54p. Available from NTIS, PC A04/MF A01.

Butadiene emission samples were collected from the process vent stream of a plant manufacturing synthetic rubber from styrene and butadiene. On-site analysis of samples was performed using a gas chromatograph equipped with a flame ionization detector. The precision of butadiene concentrations was determined from simultaneous samples collected at a nominal sampling rate of 0.050 L/min, rather than at the recommended sampling rate of 0.5 L/min. In addition, simultaneous samples were collected at both 0.20 L/min and 0.050 L/min and analyzed to determine if the mean values or precisions of the measured concentrations were influenced by the sampling rate. Acceptable precision was observed at both sampling rates, and the mean values and precisions of butadiene levels determined were statistically equal for simultaneous samples.

27093 (PB–89-151542/XAB) **National Atmospheric Deposition Program/National Trends Network (NADP/NTN) site-visitation program. October 1986 through September 1987.** Eaton, W.C.; Moore, C.E.; Murdoch, R.W.; Shores, R.C.; Ward, D.A. Research Triangle Inst., Research Triangle Park, NC (USA). Jan 1989. 84p. Available from NTIS, PC A05/MF A01.

See also PB–88-132519.

The report survey visits to the NADP/NTN precipitation collection stations are part of the network's quality assurance program and are coordinated through the NADP/NTN Quality Assurance Director's office. Research Triangle Institute, under contract to EPA, has visited approximately two-thirds of the 200 NADP/NTN sites for the purposes of verifying and documenting that pre-established siting criteria are met; assessing the uniformity of sample collection, analysis, and reporting procedures; conducting quality assurance tests of the operators' equipment and procedures, and providing technical assistance and instruction. Of the approximately 120 sites visited from October 1986 through the present, most are operating within specified guidelines.

27094 (PB–89-152250/XAB) **Health-hazard evaluation report No. MHETA 88-249-1931, Community Savings Association, Finleyville, Pennsylvania.** Sanderson, W.T.; Costa, C. National Inst. for Occupational Safety and Health, Morgantown, WV (USA). Sep 1988. 18p. (MHETA–88-249-1931). Available from NTIS, PC A03/MF A01.

In response to a request from the Occupational Safety and Health Administration, an evaluation was made of possible hazardous working conditions at the Finleyville Branch of the Community Savings Association (SIC-6036), located in Finleyville, Pennsylvania. Employees had been sensitized to a fungus and were experiencing nausea, headache, fatigue, sinus congestion, and difficulty in breathing even after action to control the fungus had been taken. The first allergic reaction was noted in October of 1986 with four more cases developing by December 5 of that same year. During early February of 1987 the wall in the storeroom was scraped, cleaned, and painted with a fungal-resistant paint. On March 16 the office was closed early due to three full-time employees suffering the aforementioned symptoms plus dermatological symptoms of an allergic reaction. Additional control efforts were likewise unsuccessful. Analysis indicated that exposure to microorganisms and an inadequate supply of fresh air were likely the causes of the symptoms experienced by these workers. The authors recommend that the ventilation, heating, and air conditioning unit be operated according to ASHRAE standards; that the storeroom wall be maintained free of microbial growth and that files in open boxes be cleaned and placed in enclosed cabinets, and humidity be adjusted.

27095 (PB–89-152276/XAB) **Protocol for determining the daily volatile organic compound emission rate of automobile and light-duty truck topcoat operations.** Salman, D. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Dec 1988. 119p. (EPA–450/3-88/018). Available from NTIS, PC A06/MF A01.

The protocol determines the daily VOC emission rate (pounds of VOC per gallon of coating solids deposited) for a complete automobile and light-duty truck topcoat operation. The protocol is designed for use in cases where (1) the topcoat emission limit is stated in units of pounds of VOC per gallon of solids deposited, (2) compliance is to be demonstrated for each day, and (3) the entire topcoat operation (i.e., all spray booths, flash-off areas and bake ovens where topcoat is applied, dried, and cured; except final off-line repair) is treated as a single entity.

27096 (PB–89-152342/XAB) **Health-hazard evaluation report No. HETA 86-121-1923, Modern Plating Corporation, Freeport, Illinois.** Daniels, W.J.; Orris, P.; Kramkowski, R.; Almaguer, D. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1988. 27p. (HETA–86-121-1923). Available from NTIS, PC A03/MF A01.

A study was made of possible hazardous working conditions at the Modern Plating Company, located in Freeport, Illinois. This company provided electroplating services for a variety of customers who require specialized plating for their products. At the time of the study the company employed 87 salaried and hourly staff. Prior to electroplating the surface of the workpiece was cleaned using solvent, acid, and alkaline materials. While several employees complained of episodic mucous membrane irritation, there were no chronic work-related health effects or nasal perforations noted. Symptoms were often linked to the addition of new acid to the plating baths in areas in which employees were working when the local exhaust ventilation did not function properly. Environmental sampling for cyanides and inorganic acids were all below their respective evaluation criteria. Electroplaters were exposed to cadmium, chromium (VI), and nickel in both personal and area samples. The authors recommend that the current ventilation system be evaluated for major deficiencies which adversely affected the performance of the overall system, that local exhaust ventilation systems be evaluated periodically, and that employees be provided with proper protective equipment and follow better work practices.

27097 (PB–89-152409/XAB) **Procedures for the preparation of emission inventories for precursors of ozone. Volume 1 (third edition).** Kersteter, S.L. Alliance Technologies Corp., Chapel Hill, NC (USA). Dec 1988. 246p. Available from NTIS, PC A11/MF A01.

See also PB–89-152391.

Procedures are described for compiling emission inventories of precursors of ozone (volatile organic compounds, nitrogen oxides and carbon monoxide) for use in less data-intensive models such as the Empirical Kinetic Modeling Approach (EKMA). Such inventories are required for submission of ozone State Implementation Plans (SIPs) for those areas required to revise their plans after December 31, 1987. The basic inventory elements - planning, data collection, emission inventory estimates, reporting - are discussed. Various examples are included to aid the agency in the understanding and use of the document.

27098 (PB–89-152524/XAB) **Health-hazard evaluation report HETA 86-356-1930, Social Security District Office, Philadelphia, Pennsylvania.** Burr, G.A.; Kline, M.K. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1988. 29p. (HETA–86-356-1930). Available from NTIS, PC A03/MF A01.

In response to a request from the manager of the District Office of the Social Security Administration, located in Philadelphia, Pennsylvania, an investigation was made of possible hazardous working conditions at that site. Employees had experienced headaches and nausea perhaps arising from cigarette smoke, kerosene, and gasoline fumes. There were times when both kerosene and gasoline were stored at a gas station next to the office building. Interior carbon dioxide (CO_2) levels ranged from 800 to 1000 parts per million. Carbon monoxide levels were negligible. Temperatures ranged from 72 to 77 degrees. Relative humidity ranged from 39 to 50%. The authors recommend that air flows and rates be adjusted, the ventilation system be cleaned and corrected, and the gas station alter its schedule. Other recommendations included making technical adjustments to some equipment and making a complaint system and safety manual available to the employees.

27099 (PB–89-152532/XAB) **Florida Acid Deposition Monitoring Program. 1987 summary report.** Environmental Science and Engineering, Inc., Gainesville, FL (USA). Dec 1988. 248p. (ESE–88103-0106-3140). Available from NTIS, PC A11/MF A01.

See also PB–86-243326.

This report presents and evaluates results of the Florida Acid Deposition Monitoring Program (FADMP) for calendar year 1987. Precipitation chemistry data from seven stations are reviewed and analyzed for statistically significant spatial patterns and seasonal trends. Results are presented for both concentrations and depositions, with major emphasis on this ions typically associated with precipitation acidity. FADMP data also are compared with measurements obtained from various national monitoring networks, such as the National Atmospheric Deposition Program (NADP) and the Utility Acid Precipitation Study Program (UAPSP). The purpose of these comparisons is to highlight the principal features of precipitation chemistry in four regions covering the eastern United States and to evaluate whether or not the character of Florida precipitation is unique among those regions. Finally, O3 data from four FADMP monitoring sites are analyzed for diurnal, seasonal, and spatial variability. Chemical, meteorological, and other environmental factors are used to explore causes of ozone variability in time and space across the state. Results, implications, and uncertainties surrounding atmospheric ozone are discussed.

27100 (PB–89-152573/XAB) **Health-hazard evaluation report HETA 88-274-1924, Office of Employment Security, Beaver Falls, Pennsylvania.** Roper, P.; Savery, H. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1988. 20p. (HETA–88-274-1924). Available from NTIS, PC A03/MF A01.

In response to a request from the Pennsylvania Social Services Union, an evaluation was made of possible hazardous working conditions at the Office of Employment Security, located in Beaver Falls, Pennsylvania. Employees had complained of dizziness; coughing; burning of the eyes, nose and throat; recurring respiratory infections; and other symptoms. The 30 employees handled unemployment benefits claims and operated a job placement service. Potential sources of air contaminants in the building included a dry toner type photocopier, fiberglass insulation inside the air supply ductwork, tobacco smoking, cleaning compounds, office furnishings and supplies, and building construction materials. No carbon-monoxide or nitrogen-dioxide levels were detected. No evidence was found to support any causal relationship between work related experiences and the symptoms expressed by the workers. The authors recommend that specific actions be taken to ensure the HVAC system is operating optimally, that parking of vehicles in the alley where the air intakes are located is prevented, and that certain ergonomic recommendations for operators of video-display units are adopted to lessen their muscle fatigue and general discomfort.

27101 (PB–89-152623/XAB) **Health-hazard evaluation report HETA 86-273-1928, Mid-America Dairymen, Inc., Monett, Missouri.** Burr, G.A.; Cantor, F.L.; Anastas, M.Y. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1988. 53p. (HETA–86-273-1928). Available from NTIS, PC A04/MF A01.

In response to a request from management at Mid-America Dairymen, Inc., located in Monett, Missouri, an evaluation was made of possible hazardous working conditions at this site. Five workers had become ill with respiratory complaints between August of 1985 and March of 1986. Symptoms included dry cough, chest tightness, fatigue, shortness of breath, and weight loss. Of six full-time employees in the electrodialysis (ED) stack maintenance department, four were diagnosed with hypersensitivity pneumonitis (HP). One worker among 12 in the cheese finishing department was diagnosed with asthma. The two-story facility employs about 75 workers in the production of cheese curd, whey protein, and powdered milk. The study was not able to identify a specific agent or antigen responsible for the illnesses; however, there was a clear association in time and place between cleaning stacks of electrodialysis membranes and the HP in four workers diagnosed with the disease. Stacks of ED membranes waiting to be cleaned can provide an ideal growth medium for microbiological species. The authors recommend that engineering and work practice changes be introduced.

27102 (PB–89-152920/XAB) **Hazard-evaluation and technical-assistance report No. TA-77-66, Platte Chemical Company, Fremont, Nebraska.** Hervin, R.L.; Daum, S.; Moses, M. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jul 1978. 45p. (NIOSH/TA–77-66). Available from NTIS, PC A03/MF A01.

In response to a request from the Platte Chemical Company, Fremont, Nebraska, an evaluation was made of possible hazardous working conditions at the site. At the time of the survey the company employed about ten persons. There was one large production line that processed several tons of granular product or pesticide per day. Four or five workers were employed in the production of a liquid product identified as a seed protectant and nutrient mixture. Employees in the granular facility were exposed to concentrations of S-(((1,1-dimethylethyl)thio)methyl)-0,0-diethyl-phosphorodithioate in excess of the environmental criteria. Heptachlor exposures in the seed protectant area were also in excess of environmental criteria. Employees were exposed to excessive levels of aliphatic solvents, benzene, captan, diazinon, and organophosphates. There was a potential exposure to free silica in the granular facility. A significant number of workers reported acute symptoms probably due to excessive pesticide and dust exposures. The authors recommend that immediate action be taken to lower potential exposures by providing improved engineering controls and practices at this site.

27103 (PB–89-152938/XAB) **Hazard-evaluation and technical-assistance report No. ta-77-68, McDaniel Art Studio, Cincinnati, Ohio.** Kronoveter, K.J. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Industrial Hygiene Section. Jun 1978. 12p. (NIOSH/TA–77-68). Available from NTIS, PC A03/MF A01.

In response to a request from the McDaniel Art Studio, located in Cincinnati, Ohio, an investigation was made of possible hazardous working conditions at the site, specifically the exposure to dust during sculpturing. Air sampling revealed potential dust exposures as high as 50 mg/m3 of total dust while using a powered disc grinder to sculpt. The sculpting process involved grinding with a 6-inch electric disc grinder or using such hand tools as files and chisels. The sculptor used primarily limestone, marble, talc, and onyx, working about 6 hours per day. The talc sculpting stone showed the presence of asbestos on bulk analysis. The sculptor wore safety glasses with side shields and an appropriate, approved respirator. An industrial vacuum cleaner was used for dust cleanup. The author recommends that the sculptor continue to use the NIOSH approved respirator and that, if possible, the disc grinder not be used on potential asbestos sources such as serpentine and talc. Wet working of the stone would reduce the dust levels significantly. Several precautionary measures are listed from a publication dealing with the health risks associated with common art and hobby materials.

27104 (PB–89-153944/XAB) **Domestic air pollution and respiratory infections in young Gambian children: analysis of data from a cross-sectional study.** Bergstra, A. Landbouwhogeschool Wageningen (Netherlands). Jun 1988. 47p. (REPT–1988-350). Available from NTIS, PC EE03/MF A01.

A cross-sectional survey on domestic air pollution and acute respiratory infections (ARI) in young children was carried out by the

Medical Research Council in The Gambia. The following risk factors for ARI were incorporated in the study: Exposure to pollutants from biomass combustion, parental smoking and lanterns, nutritional status, socioeconomic status, immunization rate, and ethnic origin. Analysis of the data showed a positive but not statistically significant association between ARI and exposure to biomass combustion productions. The use of gas oil as fuel for lanterns was an important risk factor for lower respiratory infections. Compared with other fuels, it had an odds ratio of 3.0.

27105 (PB–89-155238/XAB) **Stability of parts-per-billion hazardous organic cylinder gases and performance audit results of source test and ambient-air measurement systems. Status report 5.** Bryant, V.R.; Howe, G.B.; Tompkins, S.B.; Jayanty, R.K.M.; Sokol, C.K. Research Triangle Inst., Research Triangle Park, NC (USA). Feb 1989. 320p. Available from NTIS, PC A14/MF A01.

See also PB–88-201504.

An evaluation of 29 gaseous organic compounds at PPB levels in compressed gas cylinders was conducted by the U.S. Environmental Protection Agency (EPA). Primary objectives of this on-going project are to: (1) evaluate the quality of measurements made by EPA, state/local agencies or their contractors by using PPB gas cylinders for performance audits to assess relative accuracy of source measurement systems during hazardous-waste trial-burn tests and ambient air-monitoring programs; (2) verify the manufacturer's certified analysis of the multi-component gas mixtures; (3) determine stability of gas mixtures with time; and (4) develop new audit materials as requested by EPA. Results of these audits and description of experimental procedures used for analyses and available stability data are in Status Report No. 5.

27106 (PB–89-155246/XAB) **Precision and accuracy assessments for state and local air-monitoring networks, 1987.** Suggs, J.C. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Feb 1989. 156p. (EPA–600/3-89/015). Available from NTIS, PC A08/MF A01.

See also report for 1986, PB–88-180138.

Precision and accuracy data obtained from state and local agencies during 1987 are analyzed. Pooled site variances and average biases which are relevant quantities to both precision and accuracy determinations are statistically compared within and between states to assess the overall effectiveness and consistency in the application of various quality assurance programs. Individual site results are evaluated for consistent performance throughout the year. Reporting organizations, states and regions that demonstrate consistent precision and accuracy data as the result of effectively administered quality assurance programs are identified. This information is intended as a guide for identifying problem areas, for taking corrective action from the standpoint of improving the effectiveness of quality assurance programs, and for providing more knowledgeable decisions concerning attainment status with regards to ambient air quality standards. An approach to deal with accuracy data for individual sites is presented, and an alternative sampling design for generating precision and accuracy data is discussed.

27107 (PB–89-155253/XAB) **Analytical method evaluation for measuring ethylene oxide emissions from commercial dilute-acid hydrolytic control units. Final report.** Steger, J.; Margeson, J.H. Radian Corp., Research Triangle Park, NC (USA). Feb 1989. 149p. Available from NTIS, PC A07/MF A01.

Portions of this document are not fully legible.

The Source Branch of the Environmental Protection Agency's (EPA) Environmental Monitoring Systems Laboratory (EMSL) at Research Triangle Park, North Carolina has a program to develop stationary source test methods of known precision and accuracy for determining compliance with EPA standards. While participating in this program, Radian Corporation performed a field evaluation of a method for sampling and analyzing ethylene oxide (EO) in the vent stream from a dilute acid scrubber of a commercial sterilizer. The purposes of the test were to evaluate the ability of the analytical method to quantitate EO in scrubber emissions, to determine EO stability in sample containers, and to measure the EO concentration profile and EO-to-oxygen and EO-to-dichlorodifluoromethane (CFC-12) ratios during the initial sterilizer evacuation.

27108 (PB–89-155758/XAB) **Temperature dependence of mass accommodation of SO_2 and H_2O_2 on aqueous surfaces. Technical report (Final).** Worsnop, D.R.; Gardner, J.A.; Zahniser, M.S.; Watson, L.R.; Kolb, C.E. Aerodyne Research, Inc., Billerica, MA (USA). Jun 1988. 64p. (ARI-RR–649.2). Available from NTIS, PC A04/MF A01.

This report describes the experimental technique for accurately determining mass accommodation coefficients (or sticking coefficients) for atmospherically important trace gases. The report presents results and interpretations for SO2 and H2O2. The experimental method combines a monodisperse train of droplets 200 micrometers in diameter and a low pressure flow reactor. Uptake rates of trace gases are determined by measuring changes in trace gas number density as a function of exposed liquid surface area. Experiments with systematic variation of water vapor and inert gas partial pressures permit deconvolution of gas diffusion and temperature-dependent aqueous reactions. The implications for atmospheric models of heterogeneous chemistry are that the gas/liquid mass transfer rates will not be rate limiting for aqueous phase oxidation of SO2. However, the interpretation of the observed uptake rates for both SO2 and H2O2 implies that the rates of chemical reaction at the droplet surface may be significantly faster than those determined from bulk aqueous phase studies which are currently used in atmospheric models. For insoluble gases, surface-dependent reaction kinetics may dominate gas/liquid uptake rates under atmospheric conditions.

27109 (PB–89-156087/XAB) **Southern California Air Quality Study: tunable-diode-laser absorption spectrometer measurements of H_2O_2 and H_2CO at the Claremont and Long Beach 'A' sites. Final report.** Mackay, G.I.; Karecki, D.R.; Schiff, H.I. Unisearch Associates, Inc., Concord, ON (Canada). 9 Nov 1988. 337p. Available from NTIS, PC A15/MF A01.

See also PB–88-240445.

During the summer and fall of 1987 the State of California Air Resources Board coordinated the Southern California Air Quality Study (SCAQS) in the greater Los Angeles area to address ozone, nitrogen dioxide, and the role of nitrogen oxides, PM-10, fine particles, visibility, toxic air contaminants, and atmospheric acidity. Measurements discussed in the report were made during the summer in Claremont and during the fall in Long Beach, which represented A-site receptor and source regions, respectively. The tunable-diode-laser absorption spectrometer (TDLAS) system was employed for the real-time measurements of gas-phase hydrogen peroxide and formaldehyde. The system obtained a data point for both species every minute. Results were subsequently reduced to 1-hour average values for comparison with measurements made by other methods.

27110 (PB–89-156095/XAB) **Sensitivity of particle size to relative humidity for Los Angeles aerosols.** McMurry, P.H. Minnesota Univ., Minneapolis, MN (USA). Particle Technology Lab. Dec 1988. 28p. (PTL-PUB–654). Available from NTIS, PC A03/MF A01.

A TDMA system (Tandem Differential Mobility Analyzer) was used to measure the sensitivity of particle size to relative humidity for monodisperse Los Angeles aerosols. Measurements were made at Claremont, CA on 13 days between June 19 and Sept. 3, 1987, in conjunction with the Southern California Air Quality Study (SCAQS). The particle sizes studied ranged from 0.05 micrometer to 0.5-micrometer diameter at ambient relative humidity (typically 45-65%). The data provide clear evidence that these atmospheric aerosols were externally mixed. The data also show that for the hydrophilic aerosol fraction, the larger particles (0.4-0.5 micrometer) grew more when humidified than did the smaller particles (0.05-0.2 micrometer). The report summarizes measurement results.

27111 (PB–89-156111/XAB) **Sorption of alcohols from air on activated charcoal and determination by gas chromatography of the pentafluorobenzoyl esters. Final report.** Steinberg, S.M.; Gordon, R.J. Global Geochemistry Corp., Canoga Park, CA (USA). 21 Oct 1988. 31p. Available from NTIS, PC A03/MF A01.

As an element in the Southern California Air Quality Study of 1987, a method of increased sensitivity was developed to determine air concentrations of methanol and ethanol. The alcohols were adsorbed on charcoal and later desorbed into a reagent to form the pentafluorobenzyl esters, then analyzed by gas chromatography with electron-capture detection. Air was sampled on a 24-hour

scheduled divided into five time intervals. Approximately 200 samples were collected at Claremont (over 12 days in summer/fall) and Long Beach (19 days in summer/fall and winter). Results of the study showed that methanol concentrations were very much higher than expected. There was no discernible diurnal pattern to the methanol concentrations and no correlation between the concentrations measured simultaneously at the two sites. It is not certain if the high, variable concentrations of methanol are real, or are the result of analytical problems. It is recommended that the data not be used until additional work is performed.

27112 (PB–89-158745/XAB) **Controlling Air Toxics (CAT), Version 1.0. Tutorial manual. Report for June 1987-March 1988.** Shareef, G.S.; Johnston, M.T.; Epner, E.P.; Ocamb, D.; Berry, C. Radian Corp., Research Triangle Park, NC (USA). Aug 1988. 71p. Available from NTIS, PC A04/MF A01.

For system on diskette, see PB–89-158737.

This manual gives instructions for using Controlling Air Toxics (CAT). The primary objective of this interactive and user-friendly software package is to assist in the review of air-emission permit applications. The engineering software is based on the EPA document, Control Technologies for Hazardous Air Pollutants, EPA/625/6-86/014, September 1986. The software is written for the IBM PC using the Microsoft V3.0 C compiler and Windows for Data Library V1.0 for screen and keyboard interaction. The permit reviewer can input information on the air emission stream characteristics as well as other information in the permit application. The program provides guidance on which control devices may be appropriate and allows the reviewer to select a specific pollutant/control device combination for evaluation. The control devices included in the program are thermal and catalytic incinerators, flares, carbon adsorbers, absorbers, condensers, fabric filters, and venturi scrubbers. The program then calculates design parameters and estimates costs for each control device selected. The results can be compared against the permit applicant's actual or proposed design.

27113 (PB–89-159396/XAB) **Screening procedures for estimating the air-quality impact of stationary sources. Draft for public comment.** Brode, R.W. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Aug 1988. 140p. (EPA–450/4-88/010). Available from NTIS, PC A07/MF A01.

For system on diskette, see PB–89-159388. See also PB–274 087.

This document presents current EPA guidance on the use of screening procedures to estimate the air quality impact of stationary sources. It is an update and revision of Volume 10R of the GAQMPA series, and is intended to replace Volume 10R as the standard screening procedures for regulatory modeling of stationary sources. It is being issued as a draft for public comment until such time as a final version can be incorporated into a future supplement to the Guideline on Air Quality Models (Revised). An important advantage of the current document is the availability of the SCREEN model for executing the single-source, short-term procedures on a personal computer.

27114 (PB–89-159461/XAB) **Spatial allocation-factor procedures for the 1980 NAPAP (National Acid Precipitation Assessment Program) emissions inventory. Data file.** Mobley, J.D.; Modica, L.G.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1986. mag ta Available from NTIS CP T03.

See also PB–88-137138 and PB–87-182879. Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Price includes documentation, PB–89-159479.

This package contains documentation of the spatial allocation factor development procedures for the 1980 National Acid Precipitation Assessment Program (NAPAP) area source emissions inventory, including the Fortran programs and input data files. The goal of the spatial allocation factor development effort was to create as many spatial surrogates as possible for each county to allow the user maximum flexibility in assigning county-level area source emissions to modeling grid cells. The surrogates are used to represent the subcounty distribution of area source emissions for each emissions category. Fourteen surrogate indicators were developed for use with the NAPAP inventory based on housing, population, and land-use data. Once the subcounty distribution of each surrogate is determined, area source emissions categories are matched to the most-appropriate surrogate indicators. The resultant Spatial Allocation Factor File is input to the Spatial Allocation Module of the Flexible Regional Emissions Data System.

27115 (PB–89-159479/XAB) **Spatial allocation factor procedures for the 1980 NAPAP (National Acid Precipitation Assessment Program) emissions inventory documentation. Final report, September 1985-September 1988.** Beaulieu, T.A.; Modica, L.G.L. Alliance Technologies Corp., Bedford, MA (USA). Dec 1988. 285p. (A–87-133). Available from NTIS, PC A13/MF A01.

For system on magnetic tape, see PB–89-159461.

This report documents the development of spatial allocation factors to apportion National Acid Precipitation Assessment Program (NAPAP) area source emissions from counties to individual grid cells for input to the Regional Acid Deposition Models (RADM) and Regional Oxidant Models (ROM). The development effort focused on creating a variety of spatial surrogates to allow the user maximum flexibility in assigning area source emissions to modeling grid cells. The surrogates are used to represent the sub-county distribution of area source emissions for each category. Fourteen surrogate indicators were developed for use with the NAPAP inventory based on housing, population, and land use data. Fortran programs were developed to generate the spatial factors. These programs are available on a companion magnetic tape. The user can specify processing options and grid definition by means of control option files accessed by the programs. Once the sub-county distribution of each surrogate is determined, area source emissions categories are matched to the most-appropriate surrogate. The resultant Spatial Allocation Factor File is input to the Spatial Allocation Module of the Flexible Regional Emissions Data System.

27116 (PB–89-159628/XAB) **Geophysical monitoring for climatic change, Number 16. Summary report, 1987.** Bodhaine, B.A.; Rosson, R.M. National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab. Dec 1988. 140p. Available from NTIS, PC A07/MF A01.

See also report for 1986, PB–88-180146.

Contents include: Observatory reports; Aerosols and Radiation Monitoring Group; Carbon-cycle Group; Monitoring Trace Gases Group; Acquisition and Data Management Group; Station climatology; Air Quality Group; Nitrous Oxide and Halocarbons Group; Alkaline aerosols program: Dust emissions modeling; Arctic gas and aerosol sampling program: Springtime tropospheric ozone destruction; and Cooperative programs.

27117 (PB–89-159685/XAB) **Trace gases in and over the West Pacific and East Indian Oceans during the El Nino-southern oscillation event of 1987: a report of GMCC (geophysical monitoring for climatic change) data collected on the second Soviet-American Gas and Aerosol Experiment (SAGA II).** Butler, J.H.; Elkins, J.W.; Brunson, C.M.; Egan, K.B.; Thompson, T.M. National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab. Dec 1988. 117p. (NOAA-DR-ERL-ARL–16). Available from NTIS, PC A06/MF A01.

Five trace gases in the surface water and atmosphere of the West Pacific and East Indian Oceans were measured by automated gas chromatography from May through July 1987. The data included more than 1000 measurements each of N_2O, F11 and F12 in the surface water and in the atmosphere, and about 2000 measurements each of CH_4 and CO_2 in the surface water and atmospheric boundary layer of the West Pacific. In addition, over 600 measurements of dissolved N_2O were obtained from hydrocasts made along the entire 45,000-km cruise track. Data from this cruise are presented here in graphic and tabular form, along with detailed discussions of the methods used in analyzing the samples and reducing the data, and a brief summary of the results and their significance. Also included are results from laboratory tests of a new, automated headspace technique for dissolved N_2O and laboratory tests of the Weiss equilibrator. Data from the equilibrator tests were used to develop a mathematical model of its performance.

27118 (PB–89-162184/XAB) **Initial results from the Pawnee Eddy Correlation system for dry acid-deposition research. Forest Service research paper.** Zeller, K.; Massman, W.; Stocker, D.; Fox, D.G.; Stedman, D. Forest Service, Fort Collins, CO (USA). Rocky Mountain Forest and Range Experiment Station. Jan 1988. 37p. (FSRP-RM–282). Available from NTIS, PC A03/MF A01.

The Pawnee Grassland Eddy Correlation Dry Deposition Project is described. Instrumentation, methods of analysis, and initial data and research findings are presented. Data from this eddy correlation system show agreement with: previously observations of deposition velocities for atmospheric ozone, NO_2 and NOx; micrometeorological theory; micrometeorological site characteristics.

27119 (PB–89-165229/XAB) **Calibration procedures for mercury vapor detectors.** Roper, P. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1972. 11p. Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

Methods for producing known concentrations of mercury in the air were investigated for use in the calibration of direct-reading mercury-vapor meters. The theory tested suggested that controlled concentrations of mercury vapor in air may be produced by continuously injecting controlled amounts of mercury vapor into a flowing air stream. This controlled injection was achieved by using the vapor pressure of liquid mercury to saturate a flowing air stream. Two methods existed for the confirmation of concentration levels. These methods were continuous monitoring and chemical analysis. The continuous monitor was useful for determining when a system has reached steady state and when an upset occurs within that system which causes the generated concentration to change. Once it was precalibrated against chemically analyzed standards, this monitor can be used to determine whether generated concentrations are reproducible from time to time. Using chemical-analysis methods the vapor generated by the system was drawn through fritted bubblers containing an absorbing solution for mercury vapor. Once the concentration of mercury vapor produced by the generation system is verified, the vapor may be used for instrument calibration.

27120 (PB–89-858385/XAB) **Ozone depletion due to the use of chlorofluorocarbon: government and industry response. January 1985-March 1989 (Citations from the Biobusiness Database). Report for January 1985-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 69p. Available from NTIS PC N01/MF N01.

This bibliography contains citations concerning the response of business and government to atomospheric ozone depletion. Industrial concern expressed by voluntary restrictions in the use of chlorofluorocarbons and the search for a substitute is presented. Studies of the ozone layer and the effects of aerosols worldwide are presented. Climatic response to ozone depletion is included. Government sponsored bans on chloroflourocarbons are examined. (Contains 142 citations fully indexed and including a title list.)

27121 (PB–89-859433/XAB) **Paint and coating industry: health and safety. January 1980-March 1989 (Citations from World Surface Coatings Abstracts). Report for January 1980-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 68p. Available from NTIS PC N01/MF N01.

This bibliography contains citations concerning health and safety hazards in the paint and coating industries. The exposure to toxic chemicals, and health hazards of working with powders, solvents, and paints such as hepatitis, dermatitis, respiratory ailments are discussed. Safety regulations are included. Fire and explosion hazards in the painting industry are described. Hazards outside the workplace involving the use of these products are briefly considered. (Contains 165 citations fully indexed and including a title list.)

27122 (PINSTECH/NCD–109) **Study of trace elements in the atmosphere of PINSTECH, Nilore.** Rusheed, A.; Ahmed, S.; Mannan, A.; Qureshi, I. H. Pakistan Inst. of Nuclear Science and Technology, Rawalpindi (Pakistan). Nuclear Chemistry Div. Jun 1987. 13p. English Order Number DE88706353/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Atmospheric aerosol particulates of inorganic elements are usually transported to long distances from their source of emission. The measurement of these elements in air provides useful information for understanding aerosol effects. Therefore studies were undertaken to determine the atmospheric concentration of some inorganic elements, 23 air filter samples of 24 hour duration were collected at Nilore, Islamabad area and analysed for 16 elements by neutron activation analysis (NAA). The concentration of 9 elements were determined in more than 12 samples. Comparison of the average concentration of these elements with those observed at other sites in U.S.A and U.K., indicate a distribution pattern similar to a non-urban site with very little pollution from industerial sources. Binary collection coefficients were calculated using the data of 9 principal elements of identify particulate sources. Co, Cr, Cs, Eu, Fe, Sc and Rb were assigned a crustal source, whereas Sb could possible has an anthropogenic source. Zn was found to have a constant nearby source the exact nature of which could be ascertained after a complete analysis of local soil and other possible sources near the site. (orign./A.B.).

27123 (SVC–87-51) **Flame cutting using natural gas, propane and acetylene. Working conditions. Air pollution. Optical radiation. Noise.** Beck Hansen, E.; Eriksen, P.; Skotte, J. Svejsecentralen, Glostrup (Denmark). 1987. 97p. (In Danish). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

EFP-85.

An investigation was made of the indoor air pollution, optical radiation and noise pollution resulting from the use of flame cutters fueled with natural gas, propane and acetylene. There is no significant variation in the amounts of pollutive emission measured from these gases, though natural gas gave a lesser quantity of gas and carbon monoxide emission than did both propane and acetylene. Smoke formation constituted 96% of the total indoor air pollution measured. The initial free burning warming-up flame gave a very significant nitrous gas and carbon monoxide emission in relation to amounts emitted during the cutting process. The influence of utilization of natural gas flame cutters on the amount of optical radiation is negligible, and 85-90% of radiation is infrared. Radiation answers to a temperature radiation with 2380 K, for all three gas types and ultraviolet radiation constitutes of only 1% of the total amount. The amount of glare equals that given out by a 40 W electric bulb. It is recommended that the operator wears normal eye shields which will also be sufficient to protect him/her from all tyes of optical radiation. There is little difference in the amount of noise pollution produced by the three gas forms. Noise proportions vary according to the different processes involved, it is highest in the warming-upstage. Measurements are, at a distance of 0.5m distance 89-96 dB(A) (manual cutting), and where the distance is 2m, 79-86 dB(A) (machine cutting) depending on the size of the nozzle of the cutting instrument. (AB).

27124 (UCRL–21147) **On greenhouse gas signal detection strategies.** Schlesinger, M.E.; Barnett, T.P. Ocean Research Consultants, La Jolla, CA (USA). 24 Feb 1989. 39p. DOE Contract W-7405-ENG-48. Order Number DE89009908/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The indisputable detection of a greenhouse gas signal in the global climate system will be a true decision point for mankind. Yet, at this stage of knowledge, the details of an appropriate detection strategy are only beginning to be developed. Two key elements in the eventual strategy are the subject of this report: (1) what variables should be monitored in a detection program, and (2) the comparison of the equilibrium versus transient climate system response. Subsequent sections consider these items in turn while a final section summarizes the main conclusion of the study. 10 refs., 14 figs., 2 tabs.

27125 (USGS/WRIR–89-4006) **Climatic changes inferred fron analyses of lake-sediment cores, Walker Lake, Nevada.** Yang, In Che. Geological Survey, Denver, CO (USA). 1989. 20p. DOE Contract AI08-78ET44802. Order Number DE89010740/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Organic and inorganic fractions of sediment collected from the bottom of Walker Lake, Nevada, have been dated by carbon-14 techniques. Sedimentation rates and the organic-carbon content of the sediment were correlated with climatic change. The cold climate between 25,000 and 21,000 years ago caused little runoff, snow accumulation on the mountains, and rapid substantial glacial advances; this period of cold climate resulted in a slow sedimentation

rate (0.20 millimeter per year) and in a small organic-carbon content in the sediment. Also, organic-carbon accumulation rates in the lake during this period were slow. The most recent period of slow sedimentation rate and small organic-carbon content occurred between 10,000 and 5500 years ago, indicative of low lake stage and dry climatic conditions. This period of dry climate also was evidenced by dry conditions for Lake Lahontan in Nevada and Searles Lake in California, as cited in the literature. Walker Lake filled rapidly with water between 5500 and 4500 years ago. The data published in this report was not produced under an approved Site Investigation Plan (SIP) or Study Plan (SP) and will not be used in the licensing process. 10 refs., 3 figs., 2 tabs.

5003 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 26345, 26669, 27025, 27164, 27657

27126 (INIS-BR–1458, pp. 263) **Analysis of the wind data and estimation of the resultant γ exposure rates.** Hu, S.J. (Sains Malaysia Univ., Penang. (Malaysia). School of Physics); Katagiri, H.; Kobayashi, H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89009976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/dose rates; GAMMA RADIATION/nuclear power plants; GAMMA RADIATION/wind; DISPERSIONS; EARTH ATMOSPHERE; WIND; PARTICLE RESUSPENSION

27127 (LA-UR–89-1118) **Applications of complex terrain meteorological models to emergency response management.** Yamada, Tetsuji; Leone, J.M. Jr.; Rao, K.S.; Dickerson, M.H.; Bader, D.C.; Williams, M.D. Los Alamos National Lab., NM (USA). 1989. 20p. DOE Contract W-7405-ENG-36. (CONF-8905115–1: 2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from a nuclear installation, Luxembourg, LU, May 16, 1989). Order Number DE89009249/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Office of Health and Environmental Research (OHER), US Department of Energy (DOE), has supported the development of mesoscale transport and diffusion and meteorological models for several decades. The model development activities are closely tied to the OHER field measurement program which has generated a large amount of meteorological and tracer gas data that have been used extensively to test and improve both meteorological and dispersion models. This paper briefly discusses the history of the model development activities associated with the OHER atmospheric science program. The discussion will then focus on how results from this program have made their way into the emergency response community in the past, and what activities are presently being pursued to improve real-time emergency response capabilities. Finally, fruitful areas of research for improving real-time emergency response modeling capabilities are suggested. 35 refs., 5 figs.

27128 (PB–89-164313/XAB) **Indoor radon pollution: update. Bibliographic series.** Richard, S.A. Environmental Protection Agency, Washington, DC (USA). Information Management and Services Div. Dec 1988. 204p. (EPA/IMSD–88/014). Available from NTIS, PC A10/MF A01.

This bibliography focuses on indoor radon pollution problems and is organized according to the following major topic areas: I-Overview (covering general areas such as law and policy, popular press, communication and education, indoor air and books); II-Health Effects (epidemiology, risk estimates, and dosimetry); III-Exposure (house construction, geology, source, physical properties, and radon in water); IV-Surveys (national and international case studies); V-Mitigation; and VI-Measurement Techniques. Section VIII-Appendix, lists State Contacts.

27129 (RFP–4335) **An SF_6 tracer study for validation of a Terrain Responsive Atmospheric Code.** Brown, K.; Wilkerson, G.; Porter, R.; Langer, G.; Hodgin, R. North American Weather Consultants, Salt Lake City, UT (USA). 1988. 4p. DOE Contract AC04-76DP03533. (CONF-880463–4: 8. symposium on turbulence and diffusion of the American Meterological Society, San Diego, CA, US, April 25, 1988). Order Number DE89010428/JAW. Available from NTIS, PC A02 - OSTI.

The use of sulfur hexafluoride as a tracer gas has been ongoing for many years. As technologies have improved in the design of the real-time analyzers, so has the number of possible applications. This is a brief synopsis of one such innovative project that was conducted during the summer of 1987. The purpose of this study was to provide data for the evaluation of a dispersion model called TRAC (Terrain Responsive Atmospheric Code). TRAC is a finite element puff model designed to simulate transport and dispersion in complex terrain. The summertime program conducted by NAWC was the first in a series of four planned tests that would cover different climatological regimes. 1 ref., 5 figs.

5005 Site Resource and Use Studies

27130 (PB–89-164909/XAB) **Wetlands protection. Bibliographic series.** Environmental Protection Agency, Washington, DC (USA). Information Management and Services Div. Nov 1988. 99p. (EPA/IMSD–88/009). Available from NTIS, PC A05/MF A01.

The bibliography serves as a tool for understanding wetlands and the regulations, policies and activities that form the current framework for protection or degradation and loss. It is organized according to the following topics: Wetland types; Wetland characterization; Wetland values or functions; Trends in wetlands; Wetland mitigation; Wetland regulations and policies. Citations included in the bibliography were selected from articles and papers published between 1974 and 1987.

5006 Regulations

27131 (PB–89-151286/XAB) **Workbook for plume visual impact screening and analysis.** Latimer, D.A.; Ireson, R.G. Systems Applications, Inc., San Rafael, CA (USA). Sep 1988. 203p. (EPA–450/4-88/015). Available from NTIS, PC A10/MF A01.

For system on diskette, see PB–89-151278. See also PB–81-157885.

The Prevention of Significant Deterioration and visibility regulations of the U.S. Environmental Protection Agency (EPA) require the evaluation of a type of visibility impairment which can be traced to a single source or small group of sources known as plume blight. The Workbook presents current EPA guidance on the use of screening procedures to estimate visibility impairment due to plume blight and is an update and a revision to the earlier book. It is being issued as a draft for public comment until a final version is incorporated into the Guideline on Air Quality Models (Revised). It preserves the same 3-level screening approach and includes a new screening model (VISCREEN) that can be run on a personal computer. The VISCREEN model is used for both Level-1 and Level-2 screening analyses, and is designed to evaluate plume visual effects along multiple lines of sight across the plume's length for two different viewing backgrounds and for two different scattering angles.

27132 (PB–89-151351/XAB) **Personal-computer version of the Process Model Projection Technique (PROMPT) (Version 3.0). User's manual.** Hogan, T. Energy and Environmental Analysis, Inc., Arlington, VA (USA). Sep 1988. 67p. Available from NTIS, PC A04/MF A01.

For system on diskettes, see PB–89-151344.

This manual describes the use of the Process Model Projection Technique (PROMPT), one of four stationary source emission and control cost forecasting models developed by the EPA for the National Acid Precipitation Assessment Program (NAPAP). PROMPT projects air pollution emissions (sulfur dioxide, sulfates, and nitrogen oxides) and costs for industrial combustion and industrial processes; i.e., process heaters, furnaces, dryers, kilns, engines, turbines, and wood-fired boilers. PROMPT excludes the combustion of natural gas, distillate or residual fuel oil, and coal in industrial boilers. The outputs are provided for 1980 (baseline), 1985 (forecasted, not actual), 1990, 1995, 2000, 2010, 2020, and 2030. The manual is for Version 3.0 of PROMPT. It includes procedures and options for model operation on an IBM-AT or compatible personal computer. The model's operation is menu driven and relatively easy to use.

27133 (PB–89-152383/XAB) **Emission-inventory requirements for post-1987 ozone State Implementation Plans.** Misenheimer, D.C. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Dec 1988. 65p. (EPA–450/4-88/019). Available from NTIS, PC A04/MF A01.

See also Volume 1, PB–89-152409.

This document describes the final emission-inventory requirements related to preparation and submission of post-1987 ozone State Implementation Plans (SIPs) for those States required to revise their plans after December 31, 1987. Addressed in the document are emission-inventory requirements relating to geographic area of coverage, point-source cutoff size specifications, sources to be included, pollutants of interest, data-reporting formats, documentation requirements, quality of data base, years to be addressed, and schedule for inventory submission.

27134 (PB–89-152391/XAB) **Emission-inventory requirements for post-1987 carbon monoxide State Implementation Plans.** Braverman, T.N. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Dec 1988. 26p. (EPA–450/4-88/020). Available from NTIS, PC A03/MF A01.

See also PB–89-152383.

This document describes the final emission-inventory requirements related to preparation and submission of post-1987 carbon monoxide State Implementation Plans (SIPs) for those States required to revise their plans after December 31, 1987. Discussed in the document are emission inventory requirements relating to geographic area of coverage, point-source cutoff size specifications, sources to be included, data-reporting formats, documentation requirements, quality of data base, years to be addressed, and schedule for inventory submission.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

Refer also to citation(s) 27063

5102 Chemicals Monitoring and Transport

Refer also to citation(s) 26274, 26364, 26387, 26697, 27118, 27153, 27154, 27327

27135 (DOE/ER/60501–T1) **Development of laser-excited molecular luminescence spectrometric methods for polycyclic aromatic hydrocarbons in environmental sciences: Final progress report, March 1, 1985 to February 28, 1989.** Wineford-ner, J.D. Florida Univ., Gainesville, FL (USA). Dept. of Chemistry. 1989. 12p. DOE Contract FG05-87ER60501. Order Number DE89010616/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Our research efforts have covered eight major areas, namely Room Temperature Phosphorimetry, Constant Energy Synchronous Luminescence Spectrometry, Laser Excited Fluorescence Spectrometry, Fingerprinting of Air Particulates, a unique Self-Cleaning Cooled Belt for Low Temperature Shpolskii Spectroscopy, Molecular Emission of Gases, FT Molecular Luminescence Spectrometry and Electronic Measurement Systems. These eight areas, which have resulted in 18 DOE supported publications (see listing at end), are summarized. 18 refs.

27136 (DP-MS–88-59) **Effects of heterogeneous porous geology on ground-water flow and transport modeling in multi-aquifer systems.** Stephenson, D.E.; Duffield, G.M.; Buss, D.R.; Wadsworth, T.D. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Geraghty and Miller Modeling Group, Reston, VA (USA). 1989. 27p. DOE Contract AC09-76SR00001. (CONF-890262–4: 4. international conference on solving ground water problems with models, Indianapolis, IN, US, February 7, 1989). Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A three-dimensional model was used to investigate the influence of simple heterogeneities and discontinuities in an acquitard on ground-water flow and transport in a 17 mi^2 region of Savannah River Plant (SRP) where geologic and hydrologic control exists. Simple "holes" and faults in the confining bed were studied. These features produced variations in the distribution of hydraulic heads that could be difficult to detect without closely spaced monitoring wells in the vicinity of the feature. In terms of solute transport, however, significant changes in flow directions and rates resulted from the presence of the feature. The simulations showed that such heterogeneities and discontinuities can reverse flow directions near the feature and significantly reduce contaminant travel times to lower aquifers. The results of these model simulations indicate the importance of adequate geologic control for the accurate prediction of ground-water flowpaths in multiaquifer systems with implications for ground-water monitoring strategies, remedial system design, and risk assessments. 18 refs., 18 figs.

27137 (PB–89-145023/XAB) **Chronic effects of contaminated sediment on Daphnia magna and Chironomus tentans (journal version).** Nebeker, A.V.; Onjukka, S.T.; Cairns, M.A. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. 1988. 10p. (EPA–600/J-88/242). Available from NTIS, PC A02/MF A01.

Pub. in Bulletin of Environmental Contamination and Toxicology, Vol. 41, 574-581(1988).

Chronic tests were conducted with Daphnia magna (cladoceran) and Chironomus tentans (midge) to determine their usefulness as test organisms for chronic sediment assays, and to estimate the potential long-term impact of contaminated freshwater sediments and contaminated Superfund-site soils on freshwater invertebrates. These two species were used successfully in acute sediment tests and were shown to be useful in chronic tests in water.

27138 (PB–89-151252/XAB) **Geo-EAS (Geostatistical Environmental Assessment Software) user's guide.** Englund, E.J.; Sparks, A.R. Battelle Columbus Labs., Washington, DC (USA). Sep 1988. 182p. (EPA–600/4-88/033A). Available from NTIS, PC A09/MF A01.

For system on diskette, see PB–89-151245.

This report describes how to install and use the Geo-EAS (Geostatistical Environmental Assessment Software) software package on an IBM-PC compatible computer system. A detailed example is provided showing how to use the software to conduct a geostatistical analysis of a data set. Thirteen Geo-EAS programs are documented. The principal functions of the package are the production of 2-dimensional grids and contour maps of interpolated (kriged) estimates from sample data. Other functions include data preparation, data maps, univariate statistics, scatter plots/linear regression, and variogram computation and model fitting. Extensive use of screen graphics such as maps, histograms, scatter plots and variograms help the user search for patterns, correlations, and problems in a data set. Data maps, contour maps, and scatter plots can be plotted on an HP compatible pen plotter. Individual programs can be run independently; the statistics and graphics routines may prove useful even when a full geostatistical study is not appropriate.

27139 (PB–89-858997/XAB) **Sanitary landfills. January 1978-April 1988 (Citations from the NTIS data base). Report for January 1978-April 1988.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 188p. Available from NTIS PC N01/MF N01.

See also PB–89-859003.

This bibliography contains citations concerning the design, operation, and management of sanitary landfills. Topics include liner-materials evaluations, leachate analyses, site studies, environmental monitoring, and solid-waste management strategies. Coal-conversion and electric utility waste products, municipal refuse, and dredged-materials disposal are considered. Considerable attention is given to methane-recovery operations. Citations pertaining specifically to land disposal of hazardous materials are excluded. (This updated bibliography contains 364 citations, none of which are new entries to the previous edition.)

27140 (PB–89-859003/XAB) **Sanitary landfills. May 1988-March 1989 (Citations from the NTIS data base). Report for May**

1988-March 1989. National Technical Information Service, Springfield, VA (USA). Apr 1989. 47p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-863089. See also PB–89-858997.

This bibliography contains citations concerning the design, operation, and management of sanitary landfills. Topics include liner-materials evaluations, leachate analyses, site studies, environmental monitoring, and solid-waste management strategies. Coal-conversion and electric utility waste products, municipal refuse, and dredged-materials disposal are considered. Considerable attention is given to methane-recovery operations. Citations pertaining specifically to land disposal of hazardous materials are excluded. (This updated bibliography contains 59 citations, all of which are new entries to the previous edition.)

5103 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 26364, 26387, 27025

27141 (INIS-BR–1458, pp. 163) **Value of Pb-210 research in global biogeochemical cycles.** El-Daoushy, F. (Sweden). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LEAD 210/biogeochemistry; LEAD 210/environmental exposure pathway; LEAD 210/global aspects; ENVIRONMENTAL MATERIALS; BIOGEOCHEMISTRY; RADIUM 226; RADON 222

27142 (INIS-BR–1458, pp. 169) **Uranium contents in soil and plants.** Azam, A. (Aligarh Muslim Univ. (India)); Rajendra Prasad. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PLANTS/sample preparation; SOILS/sample preparation; URANIUM/radioecological concentration; DIELECTRIC TRACK DETECTORS; INDIA; IRRADIATION; PLANTS; QUANTITY RATIO; RIVERS; SOILS; THERMAL NEUTRONS; URANIUM

5105 Site Resource and Use Studies

Refer also to citation(s) 26432, 26433, 27130

5106 Regulations

27143 (PB–89-155204/XAB) **Biological monitoring systems for hazardous waste sites (production and analysis of analytical reference materials).** Bohman, V.R.; Blincoe, C.R.; Miller, G.C.; Scholl, R.L.; Sutton, W.W. Nevada Univ., Reno, NV (USA). Feb 1989. 191p. Available from NTIS, PC A09/MF A01.

EPA programs in pesticides, toxics, and hazardous-waste require analytical reference materials. This project emphasized the collection of and analysis of urine, fat, and blood for ultimate use as reference samples and the practicality of using certain metabolites to indicate previous exposure to chlorinated hydrocarbons. The reference samples can, with verified compound concentrations, be used as qualifying samples when evaluating a technique to use for a particular analysis. However, the reference materials may be of greatest benefit when used by laboratories to determine analytical accuracy for samples of human urine, blood, etc. This is because the standards, like the unknown samples, will contain pollutant compounds and associated metabolites (all in vivo incorporated). Dairy animals were used during this study.

27144 (PB–89-158596/XAB) **Guidelines for disposal of solid wastes and hazardous wastes. Volume 6. Technical report.** Wang, L.K.; Wang, M.H.S. Lenox Inst. for Research, Inc., MA (USA). 27 Dec 1988. 297p. (LIR–12-88/330). Available from NTIS, PC A13/MF A01.

See also Volume 5, PB–88-178108.

The following 5 government documents are compiled as the Guidelines for Disposal of Solid Wastes and Hazardous Wastes, Volume VI: (1) U.S. EPA 1987 Solid-Waste Disposal Guidelines; (2) Guidelines for the Disposal & Destruction of PCBs and PCB Items by Nonthermal Methods; (3) Applying for A Permit to Destroy PCB Waste Oil; (4) Facilities Evaluation of High-Efficiency Boiler Destruction PCB Waste; and (5) Evaluation of PCB Destruction Efficiency in An Industrial Boiler.

27145 (PB–89-160006/XAB) **No migration variances to the hazardous-waste land-disposal prohibitions: a guidance manual for petitioners. Draft report.** NUS Corp., Gaithersburg, MD (USA). Jan 1989. 64p. Available from NTIS, PC A04/MF A01.

A no migration variance is a formal decision that can be rendered by the EPA to allow the land disposal of specific, prohibited wastes not meeting the treatment standards established by EPA at a particular facility. In 1986, Congress passed the RCRA authorizing EPA to establish nationwide standards for the management of hazardous wastes. Under HSWA, RCRA Sections 3004(d), (e), and (g) were to include provisions prohibiting the land disposal of all such listed and characteristically hazardous wastes unless they are first treated. Wastes included in the EPA's land-disposal prohibitions will have to be treated by best demonstrated technology to meet the treatment standard established by EPA, unless a no migration variance is obtained.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

Refer also to citation(s) 27063, 27125

5202 Chemicals Monitoring and Transport

Refer also to citation(s) 26271, 26273, 26274, 26608, 26610, 26711, 27135, 27136, 27137, 27139, 27140

27146 (EPRI-EA–5870-CCM-Vol.5) **FASTCHEM™ package: Volume 5, User's guide to the EICM [EPRI Interim Coupled Geohydrochemical Transport Model] coupled geohydrochemical transport code.** Hostetler, C.J.; Erikson, R.L. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 105p. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This document is a user's manual and technical reference for the EPRI Interim Coupled Geohydrochemical Transport Model (EICM). The EICM code is a component of the Fly Ash and FGD Sludge Transport and Geochemistry (FASTCHEM™) code package. The EICM code performs the processing function of the FASTCHEM™ package on a mainframe computer, including the calculation of the subsurface transport of solutes and their geochemical interaction with the surrounding media. EICM uses a two-step coupling algorithm to simulate the transport of solutes. Geochemical processes included in the code include the effects of aqueous speciation, solid phase solubility, ion exchange, and specific-ion adsorption. Output from EICM consists of a printed record of the concentrations of the solutes, solids, and adsorbates along a one-dimensional streamtube as a function of time. Additional information about the thermodynamic activities of the aqueous chemical species can also be printed. The EICM code is an integral part of the FASTCHEM™ code package. A workstation preprocessor on a personal computer is used to develop conceptual models of geochemistry and transport and to create all EICM input files; it also functions as the link between the EICM simulation and the data provided by the ECHEM geochemical code and the ETUBE streamtube definition code. The EICM code in turn produces a series of graphics output files that are used by the workstation postprocessor to plot the results of an EICM simulation. 11 refs., 26 figs., 11 tabs.

27147 (LBL–26183) **Coupling of precipitation/dissolution reactions to mass diffusion.** Carnahan, C.L. Lawrence Berkeley Lab., CA (USA). Oct 1988. 15p. DOE Contract AC03-76SF00098. (CONF-880912–29: 196. American Chemical Society national meeting, Los Angeles, CA, US, September 25, 1988). Order Number

DE89010677/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Coupling of precipitation/dissolution reactions to diffusive mass transport via porosity changes has been implemented in the computer program THCC, a simulator of reactive chemical transport. The coupling is accomplished without increasing the set of primary unknowns. Porosity is included explicitly in the transport equations and is tracked by accounting for changes of volumes of precipitates. The coupling prevents the volume of a precipitated solid from exceeding available pore volume. Results of calculations are presented for two examples, each done with and without variable porosity. 14 refs., 4 figs.

27148 (NP–9764537) **Sediment-water equilibria: On the sorption of volatile chlorinated hydrocarbons and of dichlorobenzenes by sediments.** Wienberg, R.; Foerstner, U.; Haug, T.; Kienz, W. Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik. Dec 1987. 115p. (In German). Order Number DE89764537/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Berichte aus dem Arbeitsbereich Umweltschutztechnik der Technischen Universitaet Hamburg-Harburg.; no. 1.

Sorption of selected organic contaminants by aquatic sediments was examined. The sorbates used were dichloro methane, trichloro methane, 1,1,1-trichloro ethane, trichloro ethene, tetrachloro ethene and 1,2-, 1,3- as well as 1,4-dichloro benzene. For comparison parathion and hexachloro benzene were also introduced to the experiments. The sediments were taken from a freshwater tidal marsh of the Elbe river near the city of Hamburg. Sorption experiments under varied conditions brought out the following results: (1) Sorption decreased with increasing temperature. The sorption enthalpies are about 8.6 kJ/mol for all sediments and dichlorobenzenes. (2) The pH has no effect on the sorption of the dichlorobenzenes. (3) Increasing the salinity enhances the sorption. (4) Acetic acid, NTA, as well as methanole introduced to concentrations up to some g/l, showed no effect. (5) Detergents caused a marked desorption at concentrations above their critical micelle concentrations. The anionic compound TBS, however, enhanced the sorption of an acidic sediment (pH 3.5), when the concentration of the detergent was increased. The cationic TCAB exhibited at concentrations somewhat below the critical micelle concentration a marked increase of the sorption of DCB, parathion and HCB. These phenomena can be explained by the surface charge characteristics of the sediment particles.

27149 (PB–89-144646/XAB) **Characteristics of acidic lakes in the eastern United States (journal version).** Landers, D.H.; Eilers, J.M.; Brakke, D.F.; Kellar, P.E. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. 1988. 13p. (EPA–600/J-88/232). Available from NTIS, PC A03/MF A01.

Pub. in Verh. Internat. Verein. Limnol., Vol. 23, 152-162(Jan 1988).

Acidic lakes are found in many regions of the world and are especially common in those regions of the temperate northern hemisphere that have received high levels of acidic deposition during the last several decades. The National Lake Survey was a one-time fall sampling of lakes in regions of the United States suspected of containing lakes susceptible to acidic deposition. The sample lakes were statistically selected from all lakes identified on medium-scale topographic maps to permit population estimates to be calculated of the characteristics of lakes in the target populations in the regions surveyed. Acidic lakes were defined as those lakes with acid-neutralizing capacity (ANC) $<$ or $=$ 0 (as determined by Gran analysis). This definition is limiting in that only the lakes with no remaining ANC are included. It is clear that lakes with ANC $>$ 0 may be acidic based on pH; however, the rationale for defining other or additional categories of acidic lakes is beyond the scope of the presentation.

27150 (PB–89-144653/XAB) **Characteristics of lakes in mountainous areas of the western United States (journal version).** Eilers, J.M.; Brakke, D.F.; Landers, D.H.; Kellar, P.E. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. 1988. 11p. (EPA–600/J-88/240). Available from NTIS, PC A03/MF A01.

Pub. in Verh. Internati. Verein. Limnol., Vol. 23, 144-151(1988).

The U.S. Environmental Protection Agency (EPA) initiated the National Lake Survey to quantify the number, location, and characteristics of lakes in the United States with little or no acid neutralizing capacity (ANC). Presumably, the lakes with low ANC are at greatest risk to acidification from atmospheric deposition. In autumn 1984, EPA sampled 1792 lakes in the eastern United States; those results are reported in Linthurst et al. (1986). The companion project of the Eastern Lake Survey is the Western Lake Survey, conducted in autumn of 1985. The purpose of the paper is to present results of the Western Lake Survey and to illustrate the characteristics of these lakes in the context of acidic-deposition impacts.

27151 (PB–89-148456/XAB) **Assessing the sensitivity of high-altitude New Mexican wilderness lakes to acidic precipitation and trace-metal contamination. Technical report.** Lynch, T.R.; Popp, C.J.; Jacobi, G.Z.; Robertson, J. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). Oct 1988. 189p. Available from NTIS, PC A09/MF A01.

Seventeen high mountain lakes in northern New Mexico were sampled to determine their present biological and chemical condition. Sediment cores were collected at each of the lakes to determine trace-metal concentrations, diatom assemblages, and mineralogies as a function of depth. Two of the cores were age-dated using Pb-210 chronology. Eight of the lakes exhibited low alkalinities and, therefore, low capacities for neutralization. Atmospheric deposition appears to be contributing acid and trace metals associated with anthropogenic sources to some of the lakes. Trace-metal accumulations in the upper layers of Santa Fe Lake began about 60 years ago and about 10 years ago in Truchas Lake. An acid pulse (pH 5.7) associated with snow melt was documented in Santa Fe Lake, and corresponded with an observed decrease of Daphnia sp. populations. Sediment diatom assemblages in cores from Santa Fe Lake and Truchas Lake appear to be shifting to more acid tolerant species than in the past.

27152 (PB–89-149751/XAB) **Snow deposition, melt, runoff, and chemistry in a small alpine watershed, Emerald Lake Basin, Sequoia National Park. Final report, 1 July 1984-31 March 1987.** Dozier, J.; Melack, J.M.; Marks, D.; Elder, K.; Kattelmann, R. California Univ., Santa Barbara, CA (USA). Mar 1987. 166p. Available from NTIS, PC A08/MF A01.

The report describes the first two years of an investigation of the snow chemistry and hydrology of the Emerald Lake Watershed in Sequoia National Park. The investigation examined the impact of acid deposition on high-elevation ecosystems of the Sierra Nevada. The following aspects of snow deposition and melt were studied: energy inputs; pattern of snow deposition and ablation; snowpack, meltwater and runoff chemistry; stream hydrology during the melt period.

27153 (PB–89-151443/XAB) **Treatment of water supplies contaminated with toxic pollutants using tailored soils. Technical report.** Cadena, F.C. New Mexico State Univ., Las Cruces, NM (USA). New Mexico Water Resources Research Inst. Nov 1988. 63p. (WRRI–235). Available from NTIS, PC A04/MF A01.

Restoration of aquifers affected by petrochemicals may be accomplished by flushing the aquifer through natural soils that have been previously tailored with tetraalkylammonium (TAA) molecules. The modified soils can be selectively tailored to preferentially adsorb targeted hazardous substances. This innovative process for the removal of BTX (benzene, toluene and xylenes) from ground waters contaminated by gasoline and other petrochemical spills is expected to be both economically and technically feasible. The adsorptive properties of TAA tailored soils for the selective removal of hazardous organic pollutants found in waters contaminated by petrochemical spills was investigated. Effectiveness of the tailoring agents was evaluated by comparing adsorption isotherms of BTX on treated and untreated soils. Column studies were performed to estimate kinetic properties of the tailored and untailored natural soils. Modelling of pollutant transport in the column studies was used to obtain engineering design parameters.

27154 (PB–89-151518/XAB) **SARAH2: a near-field exposure assessment model for surface water.** Vandergrift, S.B.; Ambrose,

R.B. Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab. Oct 1988. 180p. (EPA–600/3-88/020). Available from NTIS, PC A09/MF A01.

The near-field surface water model (SARAH2) calculates maximum allowable hazardous-waste concentrations, based on predicted exposure to humans or aquatic life from contaminated surface water. The surface-water contamination pathways analyzed in SARAH2 include ground-water leachate from a land-disposal facility, storm runoff from a land disposal facility, and discharge through a waste water treatment facility or lagoon. The human exposure pathways considered include ingestion of treated drinking water and consumption of contaminated fish. Acceptable leachate or treated industrial waste discharge constituent concentrations are estimated by a procedure starting from chemical safety criteria in surface water, drinking water, or fish. Direct calculations predict the instream concentrations from leachate or discharge concentrations. SARAH2 is an interactive, menu-driven, modular FORTRAN computer program with three default data sets that can be modified rapidly.

27155 (PB–89-153084/XAB) **Assessment of ocean waste disposal. Task 5. Human-health impacts of waste constituents. 2. Pathogens and antibiotic- and heavy-metal-resistant bacteria. Final report.** Grimes, D.J. Maryland Univ., College Park, MD (USA). Dept. of Microbiology. May 1986. 174p. Available from NTIS, PC A08/MF A01.

See also PB–89-153076.

Disposal of wastes in the ocean has been practiced by coastal nations for many decades. All areas of the ocean have been subject to disposal use, including estuaries, nearshore, open shelf, and deep ocean sites. Until recently, it was believed that pathogenic bacteria did not survive for any significant period of time in estuarine and marine environments. Scientists and public-health workers never bothered to ask the question could viable, virulent pathogens be present in water samples even though they could not be detected by conventional plating methods. This laboratory answered this question in the affirmative for several bacterial pathogens, and this is discussed in detail. What follows in the report is a description of potentially harmful constituents of wastes, ways in which those constituents could reach humans, known incidents of human disease contracted from wastes, detection of waste-borne disease agents, management technologies, and monitoring and predictive technologies. Since the report is not just a review of the literature, not all known literature has been discussed. However, every attempt is made to include very relevant material, regardless of its age. What follows then is both a literature review and a position paper.

27156 (PB–89-153092/XAB) **Human-health impacts of waste constituents.** O'Connor, J.M.; Kneip, T.J. New York Univ., NY (USA). Inst. of Environmental Medicine. Jul 1986. 300p. Available from NTIS, PC A13/MF A01.

See also PB–89-153084.

This report evaluates real and potential human-health effects of contaminants disposed of in open waters and other media. The evaluation is carried out by identifying contaminants of major concern, estimating the potential for the identified contaminants to have a negative impact on humans, and describing pathways of movement from environmental media to the human population. Once pathways are identified, the amount of some selected contaminants that may be transported to the human population via these pathways is determined. To the extent possible, relationships between transport of contaminants and potential human health effects are described. The final evaluation of potential human health effects for waste constituents of concern is performed as an evaluation of effects due to waste disposal.

27157 (PB–89-153274/XAB) **Long-term benthic monitoring and assessment program for the Maryland portion of Chesapeake Bay: data summary and progress report (July 1984-August 1988). Volume 1-text. Volume 2-appendices.** Scott, L.C.; Holland, A.F.; Shaughnessy, A.T.; Dickens, V.; Ranasinghe, J.A. Versar, Inc., Columbia, MD (USA). Nov 1988. 681p. Available from NTIS, PC A99/MF E04.

This report presents data collected in the fourth year of a five-year study to assess long-term responses of benthic communities to changes in water quality resulting from Bay-wide clean-up efforts, and to assess the short- and long-term responses of the benthos to power-plant operations. The results of preliminary comparisons of the data with patterns identified after the first three years are also presented. The report is organized into two volumes. Volume I contains the text and summary findings as follows: July 1984 to August 1988 water-quality data, July 1984 to April 1988 sediment and taxonomic data, and July 1984 to June 1987 production and biomass data. Tables and figures were included at the end of each chapter in Volume I. Volumes II consist of Appendices A through T which contain data gathered between January 1987 and August 1988 and are supplementary to data submitted in previous data summary reports.

27158 (PB–89-858831/XAB) **Ground water pollution transport: model studies. January 1975-March 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1975-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 111p. Available from NTIS PC N01/MF N01.

This bibliography contains citations concerning analytical and numerical simulations of the movement and distribution of contaminants in ground water. Pollutant transport and dispersion, two- and three-dimensional modeling in homogeneous and heterogeneous materials, and site studies in specific hydrogeologic environments are among the topics discussed. Theoretical analyses and practical applications are included. (Contains 171 citations fully indexed and including a title list.)

27159 (PNL-SA–16365) **Estimation of sport fish harvest for risk and hazard assessment of environmental contaminants.** Poston, T.M.; Strenge, D.L. Pacific Northwest Lab., Richland, WA (USA). Jan 1989. 29p. DOE Contract AC06-76RL01830. (CONF-890452–1: 6. national conference and exhibition on hazardous wastes and hazardous materials, New Orleans, LA, US, April 12, 1989). Order Number DE89011210/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Consumption of contaminated fish flesh can be a significant route of human exposure to hazardous chemicals. Estimation of exposure resulting from the consumption of fish requires knowledge of fish consumption and contaminant levels in the edible portion of fish. Realistic figures of sport fish harvest are needed to estimate consumption. Estimates of freshwater sport fish harvest were developed from a review of 72 articles and reports. Descriptive statistics based on fishing pressure were derived from harvest data for four distinct groups of freshwater sport fish in three water types: streams, lakes, and reservoirs. Regression equations were developed to relate harvest to surface area fished where data bases were sufficiently large. Other aspects of estimating human exposure to contaminants in fish flesh that are discussed include use of bioaccumulation factors for trace metals and organic compounds. Using the bioaccumulation factor and the concentration of contaminants in water as variables in the exposure equation may also lead to less precise estimates of tissue concentration. For instance, muscle levels of contaminants may not increase proportionately with increases in water concentrations, leading to overestimation of risk. In addition, estimates of water concentration may be variable or expressed in a manner that does not truly represent biological availability of the contaminant. These factors are discussed. 45 refs., 1 fig., 7 tabs.

5203 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 27025

27160 (DPST–88-324) **Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek.** Gladden, J.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. Feb 1988. 14p. DOE Contract AC09-76SR00001. Order Number DE89010414/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Available biological data on macroinvertebrate and fish communities in nonthermal reaches of Four Mile Creek were evaluated to determine whether outcropping of effluents from the F- and H-Area seepage basins has adversely affected instream communities. The available data were not adequate to evaluate possible local effects associated with the outcropping zones into Four Mile Creek.

However, the cumulative effects of the seepage basin effluent outcropping and all other effluent releases into the upper reaches of Four Mile Creek do not appear to have resulted in deleterious changes in either macroinvertebrate or fish communities. 7 refs., 3 tabs.

27161 (INIS-BR–1458, pp. 199) **Biological control on the vertical flux of artificial radionuclides in marine waters.** Fowler, S.W. (International Lab. of Marine Radioactivity (Monaco)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIONUCLIDE MIGRATION/biological availability; RADIONUCLIDE MIGRATION/levels; RADIONUCLIDE MIGRATION/pacific ocean; AMERICIUM; FALLOUT DEPOSITS; PLANKTON; PLUTONIUM; LEVELS; SEAWATER; WASHOUT

27162 (INIS-mf–11357) **Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.** International Atomic Energy Agency, Vienna (Austria). 1988. 339p. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, CN, June 15, 1987). Order Number DE89610309/JAW. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The Proceedings of the Regional Executive Management Seminar on Isotope Techniques in Water Resources Development and Management and the Regional Workshop on Isotope Hydrology for Asia and the Pacific organized by the IAEA and held in Beijing between 15-26 June 1987 includes the review papers and the technical papers presented. A separate abstract was prepared for each of the 21 papers. Refs, figs and tabs.

27163 (NP–9770343) **Environmental studies at pre-operational and operational stages of nuclear power plants in Italy. Chemical and radioanalytical implications.** Queirazza, G.; Guzzi, L.; Ciceri, G.; Frigieri, P. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare; Centro Informazioni Studi Esperienze, Milan (Italy). Oct 1987. 23p. Order Number DE89770343/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The criteria currently adopted by the Italian Electricity Board (ENEL) to assess the capacity of the acquatic environment to receive radioactive liquid discharges from nuclear power plants are described. The behaviour of radionuclides and their stable isotopes in coastal seawater, in the presence of suspended matter, and sediments was studied at Montalto di Castro, where a nuclear power plant is being constructed. The environmental concentrations of dissolved elements that might be discharged by a reactor were determined. Large fractions of the total trace elements in seawater were found (by ultrafiltration techniques) to be associated with the finest particle fraction (m.m. < 1000). Most of the elements could be leached from the particulates with 0.3 M hydrochloric acid. This indicates that the leachable elements may become available to organism. Distribution coefficients (particulate/water) were determined. Investigations of Cs-137 concentrations in various sediments showed Cs-137 to have a preference for sandy-clay. The concentrations of trace elements in pore water were also determined. Similar studies were carried out in the Po river system after scheduled releases of low-level radioactive liquid waste. Concentration factors for Co-60, Mn-54 and Zn-65 in fish, acquatic plants and molluscs are reported. The concentrations of radionuclides found in the sediments, the acquatic plants, and fish were low and, in most cases, indistinguishable from the background. The aim of these studies was to obtain adequate knowledge of the ability of the environment to accept radioactive liquid wastes without being harmed.

27164 (PB–89-155857/XAB) **Radionuclide distributions and sorption behavior in the Susquehanna-Chesapeake Bay system.** McLean, R.I.; Domotor, S.L.; Olsen, C.R.; Larsen, I.L.; Lowry, P.D. Maryland Power Plant Research Program, Annapolis, MD (USA). Jan 1989. 114p. (PPRP/PPER-R–12). Available from NTIS, PC A06/MF A01.

Radionuclides released into the Susquehanna-Chesapeake System from the Three Mile Island, Peach Bottom, and Calvert Cliffs nuclear power plants are partitioned among dissolved, particulate, and biological phases and may thus exist in a number of physical and chemical forms. This project measured the dissolved and particulate distributions of fallout ^{137}Cs; reactor-released ^{137}Cs, ^{134}Cs, ^{65}Zn, ^{60}Co, and ^{58}Co; and naturally occurring ^{7}Be and ^{210}Pb in the lower Susquehanna River and Upper Chesapeake Bay. In addition, suspended particles and bottom sediments were chemically leached in the laboratory to determine radionuclide partitioning among different particulate-sorbing phases to complement the site-specific field data. This information has been used to document the important geochemical processes that affect the transport, sorption, distribution, and fate of reactor-released radionuclides (and by analogy, other trace contaminants) in this river-estuarine system. The results from the project provide the information necessary for developing accurate radionuclide-transport and biological-uptake models.

5205 Site Resource and Use Studies

27165 (PB–89-155774/XAB) **Cape Cod Qquifer Management Project (CCAMP) bibliographies: publications and maps. Final report.** Environmental Protection Agency, Boston, MA (USA). Region I. Oct 1988. 37p. (EPA–901/3-88/002). Available from NTIS, PC A03/MF A01.

See also PB–89-155808 and PB–89-106298.

Recent contamination of both public and private supply wells in parts of Cape Cod, MA caused the need to examine the adequacy of existing ground-water protection programs and recommend improvements. From that project came a survey of available sources of information. From an inventory of books, reports, maps, and journal articles in the EPA Library and offices of DEQE, CCPEDC, and USGS (the participating agencies) came a consolidated list of over 300 reports, books, maps and journal articles dealing with groundwater related topics with emphasis on Cape Cod, MA, particularly Barnstable and Eastham. To make the listing easier to use, it was separated by type of material: bibliographic citations and map references. While bibliographies are generally listed by author, they are listed here by title because the emphasis in this collection was on subject related material and many of the references did not have authors. Information on each title may include source of publication, date, author, and abstract or publication or type of map; location, if owned by one of the participating agencies and call number (for publications).

27166 (PB–89-155782/XAB) **Cape Cod Aquifer Management Project (CAMP). Executive summary.** Environmental Protection Agency, Boston, MA (USA). Region I. Sep 1988. 20p. (EPA–901/3-88/003). Available from NTIS, PC A03/MF A01.

See also PB–89-155774.

The Cape Cod Aquifer Management Project (CCAMP) was initiated in September 1985 to examine the effectiveness of the way in which the ground-water resource was being protected due to concern over the increasing contamination of the water supplies on Cape Cod, MA. This is a summary of the two-year intergovernmental project which strived to establish new institutional arrangements among levels of government in order to implement a resource-based approach to groundwater protection to refine the way ground-water is managed on Cape Cod. It was intended to provide a model for other areas in the state, region or nation.

27167 (PB–89-155790/XAB) **Cape Cod Aquifer Management Project (CCAMP): guide to contamination sources for wellhead protection. Draft report.** Noake, K.D.; Gallagher, T.; Crystal, R. Environmental Protection Agency, Boston, MA (USA). Region I. Sep 1988. 320p. (EPA–901/3-88/004). Available from NTIS, PC A14/MF A01.

See also PB–89-155782.

Developed through the combined efforts of scientists, engineers, planners and regulators representing the four agencies participating in the Cape Cod Aquifer Management Project (CCAMP), this manual provides detailed information on 16 potential ground-water contaminants or classes of contaminants and 32 common land-use

categories. It covers the threat each land use may pose to groundwater quality, key examples of the products that contain a particular contaminant, common uses of the product or contaminant and the behavior and mobility of the contaminant in the soils and groundwater. For each land-use category, Best Management Practices (BMPs) are described. The Guide includes the Land Use/Public Supply Well Pollution Potential Matrix which is presented as a poster and is intended to be used as a convenient reference source.

27168 (PB–89-155808/XAB) **Cape Cod Aquifer Management Project (CCAMP): demonstration of a geographic information system for ground water protection.** Steppacher, L. Environmental Protection Agency, Boston, MA (USA). Region I. Sep 1988. 51p. (EPA–901/3-88/005). Available from NTIS, PC A04/MF A01.

See also PB–89-155790.

This publication summarizes the application of GIS Technology to the project. Geographic Information systems (GIS) technology has the capability of overlaying various mapped data layers, determining distances from fixed points, automatic changing of map scales, and preparing maps from tabular point data to better understand the complex issues involved in decision making. GIS was used for a series of pilot analyses for Cape Cod. The work concentrated on the development of a digital data base and assessment at three different geographic levels of analysis: (1) the zone of contribution to nine public water-supply wells in a highly urbanized area; (2) a rural, seasonally populated, summer tourist town; and (3) the Cape Cod peninsula. The project was designed to raise issues and answer the types of ground water management questions being asked on Cape Cod, but also those faced by ground water managers in other areas of the country as well.

27169 (PB–89-158885/XAB) **Resource document for consideration of the Lewiston Basin aquifer as a sole-source aquifer.** Environmental Protection Agency, Seattle, WA (USA). Office of Ground Water. Apr 1988. 32p. (EPA–910/9-88/193). Available from NTIS, PC A03/MF A01.

See also PB–89-158893.

The Asotin County (Washington) Public Utility District petitioned the Environmental Protection Agency (EPA) to declare its drinking-water supply as a sole-source aquifer under Section 1424(e) of the Safe Drinking Water Act. In response, EPA prepared a document which briefly describes the geology, ground-water hydrology, and drinking-water consumption of the Lewiston Basin. The report describes the technical basis for EPA proposing to designate the Lewiston Basin Aquifer System as a sole-source aquifer. The Lewiston Basin is an approximately 500 square mile structural and topographic depression in southeastern Washington and western north-central Idaho, including part of the Nez Perce Indian Reservation. Major faults and anticlinal folds form most of the boundaries of the ground-water basin. Ground-water provides about 68% of the drinking water consumed in the Lewiston Basin. Community water-supply wells all withdraw drinking water from the Grande Ronde Basalt. However, according to the EPA guidelines, those supplies cannot economically serve all those who depend upon the aquifer system for drinking water.

27170 (PB–89-158893/XAB) **Support document for designation of the Lewiston Basin aquifer as a sole source aquifer.** Environmental Protection Agency, Seattle, WA (USA). Office of Ground Water. Sep 1988. 32p. (EPA–910/9-88/194). Available from NTIS, PC A03/MF A01.

See also PB–89-158885.

The Asotin County (Washington) Public Utility District petitioned the Environmental Protection Agency (EPA) to declare its drinking-water supply as a sole-source aquifer under Section 1424(e) of the Safe Drinking Water Act. In response, EPA prepared a document which briefly describes the geology, ground-water hydrology, and drinking-water consumption of the Lewiston Basin. The report describes the technical basis for EPA's decision to designate the Lewiston Basin Aquifer System as a sole-source aquifer. The Lewiston Basin is an approximately 500 square mile structural and topographic depression in southeastern Washington and western north-central Idaho, including part of the Nez Perce Indian Reservation. Ground water provides about 68% of the drinking water consumed in the Lewiston Basin. Community water supply wells all withdraw drinking water from the Grande Ronde Basalt. However, according to EPA guidelines, those supplies cannot economically serve all those who depend upon the aquifer system for drinking water.

5206 Regulations

Refer also to citation(s) 27143, 27144

27171 (AD-A–202884/3/XAB) **Puget Sound dredged disposal analysis (PSDDA). Unconfined, open-water disposal sites for dredged material. Phase 1 (central Puget Sound). National Environmental Policy Act (NEPA)/State Environmental Policy Act (SEPA). Final environmental impact statement.** Corps of Engineers, Seattle, WA (USA). Seattle District. Jun 1988. 607p. Available from NTIS, PC A99/MF A01.

See also AD-A202 885.

This final environmental impact statement evaluates alternatives considered in identifying preferred sites for disposal of dredged material in Central Puget Sound. Three public mult-iuser disposal sites (Commencement Bay, Elliott Bay, and Port Gardner) are identified for use based on a site-selection process that considered several alternative sites. Alternative biological effects conditions for site management were considered and a site condition identified for purposes of dredged material management at the Phase I sites.

27172 (AD-A–202885/0/XAB) **Puget sound dredged disposal analysis (PSDDA). Management plan report (MPR), unconfined, open-water disposal of dredged material. Phase 1 (central Puget Sound). Final environmental impact statement.** Corps of Engineers, Seattle, WA (USA). Seattle District. Jun 1988. 162p. Available from NTIS, PC A08/MF A01.

See also AD-A202 884.

This final environmental impact statement evaluates alternatives considered in identifying preferred sites for disposal of dredged material in central Puget Sound. Three public multi-user disposal sites (Commencement Bay, Elliott Bay, and Port Gardner) are identified for use based on a site-selection process that considered several alternative sites. Alternative biological-effects conditions for site management have been considered and a site condition identified for purpose of dredged material at the Phase I sites.

27173 (PB–89-152037/XAB) **Chesapeake bay nonpoint source programs.** Environmental Protection Agency, Annapolis, MD (USA). Chesapeake Bay Liaison Office. Jan 1988. 129p. Available from NTIS, PC A07/MF A01.

This report describes the current programs to ameliorate nonpoint sources of pollution to the Chesapeake Bay that have been developed by the four jurisdictions in cooperation with other agencies, the achievements to date in terms of pollutant removal, and recommendations for future directions of the Bay Program over the next several years.

27174 (PB–89-152698/XAB) **Economic analysis of proposed amendments to water pollution regulations: phosphorus discharges R87-6. Final report.** Blaser, W.L.; Rickert, W.R.; Carlson, J.L.; Huggins, D.B. Blaser, Zeni and Co., Springfield, IL (USA). Jan 1989. 195p. Available from NTIS, PC A09/MF A01.

This report provides an analysis of proposed statewide regulations to exempt twenty-one point sources from the requirement to limit total phosphorus in their effluent to 1.0 mg/1. The proposed regulations would provide exemptions to point sources more than 25 miles from an impoundment, which have a population equivalent of more than 1500 and less than 2500, or which are tributary to Lake Decatur. Phosphorus is considered to be the limiting nutrient which usually determines the amount of algae, photoplankton, and macrophytes that grow in bodies of water. Six lakes which have treatment plants that would be affected by the proposed regulation are: Crab Orchard Lake, Lake Decatur, Pistakee Lake, Lake Charleston, Lake Shelbyville, and Lake Carlyle. The principal benefits, if the proposal were to be adopted, would be a reduction in the costs of operation and maintenance of the waste-water-treatment plants tributary to the affected lakes. The primary cost would be a decline in aquatic recreation.

27175 (PB–89-155527/XAB) **SRF (State Revolving Fund) Letter of Credit: how is it used in EPA's (Environmental Protection**

Agency's) state revolving fund program. Environmental Protection Agency, Washington, DC (USA). Office of Municipal Pollution Control. Sep 1988. 55p. (EPA–430/09-88/009). Available from NTIS, PC A04/MF A01.

See also PB–88-169784.

The brochure supplements the EPA publication Initial State Guidance for State Revolving Funds. It explains in detail EPA's Letter of Credit system. The appendix includes a glossary of program terminology, key provisions of the SRF Initial Guidance, and IRS Notice 88-54 on the tax-exempt status of the program. A list of contact persons is also included.

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social and Economic Studies

Refer also to citation(s) 26603

5302 Assessment of Energy Technologies

Refer also to citation(s) 27765

27176 (DOE/EIS–0119D) **Decommissioning of eight surplus production reactors at the Hanford Site, Richland, Washington: Draft environmental impact statement.** USDOE, Washington, DC (USA). Mar 1989. 449p. Order Number DE89010153/JAW. Available from NTIS, PC A19/MF A01 - OSTI; GPO Dep.

The purpose of this Draft Environmental Impact Statement (DEIS) is to provide environmental information to assist the US Department of Energy (DOE) in the selection of a decommissioning alternative for the eight surplus production reactors at the Hanford Site, Richland, Washington. Five alternatives are considered: (1) No Action, in which the reactors are left in place and the present maintenance and surveillance programs are continued; (2) Immediate One-Piece Removal, in which the reactor buildings are demolished and the reactor blocks are transported in one piece on a tractor-transporter across the Site along a predetermined route to an onsite low-level waste burial area; (3) Safe Storage Followed by Deferred One-Piece Removal, in which the reactors are temporarily stored in a safe, secure status for 75 years, after which the reactor buildings are demolished and the reactor blocks are transported in one piece on a tractor-transporter across the Site along a predetermined route to an onsite low-level waste-burial area; (4) Safe Storage Followed by Deferred Dismantlement, in which the reactors are temporarily stored in a safe, secure status for 75 years, after which they are fully dismantled and any remaining radioactive waste is transported to a low-level waste-burial area on the Hanford Site; and (5) In Situ Decommissioning, in which the reactors remain at their present locations, contamination is immobilized, major voids are filled, potential pathways (openings such as large pipes, air ducts, and doors) are sealed, and an engineered mound of building rubble, earth, and gravel is constructed over the decommissioned reactor to act as a long-term protective barrier against human intrusion, water infiltration, and water and wind erosion. A second No Action alternative of closing the facilities and doing nothing further is neither responsible nor acceptable and is not considered further. 2 refs., 44 figs., 95 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 27044

5502 Biochemistry

Refer also to citation(s) 26438, 27047

27177 (DOE/ER/13907–1) **[Study of plant cells and tumors]: Progress report.** Case Western Reserve Univ., Cleveland, OH (USA). [1989]. 10p. DOE Contract FG02-88ER13907. Order Number DE89010397/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Studies of the cell and molecular biology of animal cell tumors has long been recognized as a fertile and productive area for obtaining new and fundamental insights into mechanisms regulating the growth and differentiation of animal cells. As a novel approach to studying similar phenomena in plant cells, we have isolated a number of tumors in the small cruciferous plant Arabidopsis thaliana and have begun to characterize these at the cellular and molecular levels. Studies at the cellular level should lead to new insights into the relationships between hormones, cell growth and cell differentiation, while studies at the molecular level may reveal and allow us to isolate genes involved either in the hormone response, or in other important aspects of the cells' growth regulatory network. Tumors were induced on the plant by irradiation of seed or seedlings with Co-60 gamma rays. When placed in culture, these tumors were able to grow on hormone-free medium, in contrast to normal plant tissues which requires both an auxin and a cytokinin for growth. In the first phase of this project, we have concentrated on characterizing the growth, general phenotype, and hormonal sensitivity of the tumors. These studies will lead into a molecular analysis of the changes expressed in each tumor which may be responsible for the altered phenotype. 7 refs., 1 tab.

27178 (DOE/ER/13909–1) **[Structure and function of the self-incompatibility proteins of Brassica oleracea]: Progress report.** Cornell Univ., Ithaca, NY (USA). [1989]. 6p. DOE Contract FG02-88ER13909. Order Number DE89010398/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

S-locus specific glycoproteins were purified from S_6 stigmas following agarose gel isoelectric focusing of stigma extracts and elution from briefly stained gel slices. The purity of the proteins was determined by sodium deodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and silver staining. The purified protein was then used to immunize BALB/c mice at the Cornell Monoclonal Facility. Cells of a mouse whose serum reacted with stigma SLSG were fused to a myeloma cell line, and hybridoma supernatants were screened by Western analysis. Several positive supernatants have been identified. One monoclonal, MAbH8, has been characterized as being specific to a protein epitope of SLSG. This conclusion was arrived at by reacting MabH8 with a series of bacterial β-galactosidase-SLSG fusion proteins. The specificity of MAbH8 and the applications in which we have used it are described below. For the production of β-galactosidase-SLSG fusion proteins, the pWR590 family of expression vectors were used. Gene fusions with the complete or truncated versions of the SLSG coding sequence were produced by inserting the appropriate restriction fragments into the polylinker of pWR590 vectors. Following transformation of E. coli cells with these gene fusions, the fusion proteins were purified from bacterial extracts by electroelution from SDS-PAGE gel slices. Immunoblot analysis of these fusion proteins with MAbH8 has demonstrated that the epitope recognized by this monoclonal is a peptide located in the amino-terminal conserved domain of the SLSG molecule. 6 refs., 1 fig.

27179 (LA–11559-PR) **Life Sciences Division annual report, 1988.** Marrone, B.L.; Cram, L.S. (comps.). Los Alamos National Lab., NM (USA). Apr 1989. 100p. DOE Contract W-7405-ENG-36. Order Number DE89010544/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report summarizes the research and development activities of Los Alamos National Laboratory's Life Sciences Division for the calendar year 1988. Technical reports related to the current status of projects are presented in sufficient detail to permit the informed reader to assess their scope and significance. Summaries useful to the casual reader desiring general information have been prepared by the Group Leaders and appear in each group overview. Investigators on the staff of the Life Sciences Division will be pleased to provide further information.

27180 (PB–89-859292/XAB) **Chemical and biological warfare: biology, chemistry, and toxicology. February 1981-April 1988 (Citations from the NTIS data base). Report for February 1981-April 1988.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 186p. Available from NTIS PC N01/MF N01.

See also PB–89-859300.

This bibliography contains citations concerning the toxicology of chemical and biological agents; general biological and medical studies; and the properties, synthesis, and reactions of chemical agents and related compounds. Other published searches in this series cover detection and warning, defoliants, protection, general studies, and biochemistry and therapy of chemical agents. (This updated bibliography contains 348 citations, none of which are new entries to the previous edition.)

27181 (PB–89-859300/XAB) **Chemical and biological warfare: biology, chemistry, and toxicology. May 1988-April 1989 (Citations from the NTIS data base). Report for May 1988-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 103p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-862990. See also PB–89-859292.

This bibliography contains citations concerning the toxicology of chemical and biological agents; general biological and medical studies; and the properties, synthesis, and reactions of chemical agents and related compounds. Other published searches in this series cover detection and warning, defoliants, protection, general studies, and biochemistry and therapy of chemical agents. (This updated bibliography contains 134 citations, all of which are new entries to the previous edition.)

5503 Cytology

Refer also to citation(s) 27043, 27320, 27321

5504 Genetics

Refer also to citation(s) 27179, 27755

27182 (AD-A–203112/8/XAB) **Strategy for isolation of gene activation factors. Technical report, July 1987-August 1988.** Chang, H. Naval Medical Research Inst., Bethesda, MD (USA). Nov 1988. 14p. (NMRI–88-33). Available from NTIS, PC A03/MF A01.

How genes activate one another has been a central problem in biology. One mechanism is that certain genes produce trans-activating factors, which stimulate others, but the former have been difficult to isolate since they may be distant from the latter. This report describes a possible solution to this problem. Recombinant DNA technology can be used to construct a vector composed of gene regulatory (e.g. promoter) sequences fused inframe to a reporter gene, plus a selectable marker. When this vector is placed into permissive host cells, transfection of additional DNAs (syngeneic with the source of the regulatory sequences) may serve to activate the reporter gene. These new DNAs, which encode trans-activating factors, then can be rescued with species-specific or linked probes.

5505 Metabolism

Refer also to citation(s) 26203, 26254, 26418

27183 (DOE/ER/13495–T2) **[Anaerobic metabolism of aromatic compounds by phototrophic bacteria: biochemical aspects]: Annual progress report, April 1988–March 1989.** Harwood, C.S.; Gibson, J. Cornell Univ., Ithaca, NY (USA). 1989. 3p. DOE Contract FG02-86ER13495. Order Number DE89010644/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Intensive efforts to define a protocol for generating transposon mutations in R. palustris have continued. An indirect approach, in which a transposon is introduced into a pLAFR1 cosmid containing an approximately 20 kb fragment of R. palustris DNA from a λ derivative containing Tn5, appears promising. Both plasmids can be introduced into E. coli, and the antibiotic resistances coded for by each subsequently mated into wild-type R. palustris. A mutant isolated following chemical mutagenesis which is unable to grow aerobically on 4-OH benzoate (CGA033) has been complemented biochemically by the same clone which functions in the absence of the transposon; in addition, and more importantly, this indirect transposon mutagenesis appears to yield mutants with novel phenotypes affecting the anaerobic pathway for 4-OH benzoate utilization. 2 refs.

5506 Medicine

Refer also to citation(s) 27179, 27216, 27680

27184 (AD-A–203111/0/XAB) **Reconstruction of 3-d positron emission with maximum likelihood. Final report, October 1985-September 1987.** Weathersby, P.K.; Survanshi, S.S.; Meyer, P. Naval Medical Research Inst., Bethesda, MD (USA). Nov 1988. 42p. (NMRI–88-24). Available from NTIS, PC A03/MF A01.

The statistical principle of maximum likelihood (ML) has recently been applied to positron image reconstruction with devices that obtain a two-dimensional (2-D) image, (e.g., a single cross-section of a human head). The authors explored implementation of ML in simulated data from a three-dimensional (3-D) device consisting of planar parallel gamma cameras. A coarse image of 3-D rectangular modules simulated with a perfect detector had good recovery of edges and average count intensity even with count rates under 20 emissions per individual volume element. Using the summary statistics from that exploration, a complex 3-D object that corresponds to an experiment in human physiology was investigated. Recovery of that image depends strongly on details of camera performance included in the simulation and ML algorithm. The best algorithm depended on which image features were desired from the data. Quantitative recovery of actual complex images having less than 100 emissions per element is not feasible with current techniques.

27185 (BNL–42522) **Boronated porphyrins in NCT: Results with a new potent tumor localizer.** Kahl, S.B.; Koo, M.S.; Laster, B.H.; Fairchild, R.G. Brookhaven National Lab., Upton, NY (USA). 1988. 6p. DOE Contract AC02-76CH00016. (CONF-8805150–11: 4. international conference on neutron capture therapy, Bremen, DE, May 31, 1988). Order Number DE89010568/JAW. Available from OSTI; GPO Dep.

Several chemical methods are available for the solubilization of boronated porphyrins. We have previously reported the tumor localization of nido carboranyl porphyrins in which the icosahedral carborane cages have been opened to give B_9C_2 anions. One of these species has shown tumor boron levels of nearly 50 μg B/g when delivered by week-long subcutaneous infusions. We report here recent in vivo experiments with a new, highly water-soluble porphyrin based on the hematoporphyrin-type of compound in which aqueous solubility is achieved using the two propionic acid side chains of the "natural" porphyrin frame. 7 refs.

27186 (DOE/OR/00033–T425) **Development of antibody-based fiber optic sensors.** Tromberg, B.J. Oak Ridge Associated Universities, Inc., TN (USA). Mar 1988. 174p. DOE Contract AC05-76OR00033. Order Number DE89010613/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

Fluoroimmunosensors (FIS) employ an immobilized reagent phase at the sampling terminus of a single quartz optical fiber. Laser excitation of antibody-bound analyte produces a fluorescence signal which is either directly proportional (as in the case of natural fluorophor and "antibody sandwich" assays) or inversely proportional (as in the case of competitive-binding assays) to analyte concentration. Factors which influence analysis time, precision, linearity, and detection limits include the nature (solid or liquid) and amount of the reagent phase, the method of analyte delivery (passive diffusion, forced convection, etc.), and whether equilibrium or non-equilibrium assays are performed. Data will be presented for optical fibers whose sensing termini utilize: (1) covalently-bound solid antibody reagent phases, and (2) membrane-entrapped liquid and solid antibody reagents. Assays for large-molecular weight proteins (antigens) and small-molecular weight, carcinogenic, polynuclear aromatics (haptens) will be considered. In this manner, the influence of a system's chemical characteristics and measurement requirements on sensor design, and the consequence of various sensor designs on analytical performance, will be illustrated. 153 refs., 31 figs., 7 tabs.

27187 (INIS-BR–1458, pp. 181) **Effect of pelvic bones on absorbed gamma dose during irradiation of cervix carcinoma.** El-Bakkoush, F.A. (Tajura Nuclear Research Center, Tripoli (Libya)); Akki, T.S.; Megahid, R.M.; Khalaf, M.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of*

the 4. International Symposium on Radiation Physics-Abstracts. Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CARCINOMAS/irradiation; CARCINOMAS/radiotherapy; SKELETON/depth dose distributions; SKELETON/pelvis; SKELETON/radiotherapy; BIOLOGICAL RADIATION EFFECTS; CARCINOMAS; IRRADIATION; RADIOTHERAPY; CESIUM 137; COBALT 60; GAMMA RADIATION; GAMMA SOURCES; SKELETON; PELVIS; THERMOLUMINESCENT DOSEMETERS

27188 (INIS-BR–1458, pp. 182) **Physics of irradiation technique in head and neck carcinoma: a modified approach.** Datta, R. (Louisiana State Univ., Shreveport (USA)); Datta, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CARCINOMAS/irradiation procedures; CARCINOMAS/radiotherapy; HEAD/carcinomas; NECK/carcinomas; CARCINOMAS; RADIOTHERAPY; DOSIMETRY; HEAD; LINEAR ACCELERATORS; NECK

27189 (INIS-BR–1458, pp. 195) **Imaging of the simulated anatomic liver phantom.** Chowdhury, M.S. (Dacca Univ. (Bangladesh). Dept. of Physics); Chowdhury, A.H.; Ahmed, K. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LIVER/images; LIVER/phantoms; LIVER/simulation; AQUEOUS SOLUTIONS; COLLIMATORS; FLOODS; GAMMA CAMERAS; KEV RANGE 100-1000; LIVER; IMAGES; PHANTOMS; SIMULATION; TECHNETIUM 99

27190 (INIS-mf–11404) **Abstracts of the Charite-symposium 'CT and MR in medicine'.** Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. 144p. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, DD, October 17, 1988). Order Number DE89610549/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

127 abstracts of papers read at the Charite-symposium are presented. They chiefly deal with the diagnostic application of computerized tomograhpy and NMR imaging in clinical and surgical medicine comprising the use of contrast media. CT and MR in relation to irradiation planning and possibilities in image processing such as the new picture archiving and communication system (PACS) are included as well.

27191 (INIS-mf–11406, pp. 16) **Prevention of neointimal formation in de-endothelialized rat aorta.** Weshler, Z. (Hadassah Univ. Hospital, Jerusalem (Israel). Dept. of Oncology); Ocon, E.; Pizoff, H.; Gotsman, M.S.; Eldor, A. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

AORTA/external irradiation; AORTA; ENDOTHELIUM; NEOPLASMS; RATS

27192 (INIS-mf–11406, pp. 99) **Radioactivity and chemical composition of the therapeutic mud, and the hot spring baths in the 'Moriah' spa, Dead Sea, Israel.** Gold, B. (Israel Atomic Energy Commission, Beersheba (Israel). Nuclear Research Center-Negev); Sukenik, S.; Gavra, Z. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BALNEOLOGY/dead sea; THERMAL SPRINGS/chemical composition; THERMAL SPRINGS/radioactivity; BALNEOLOGY; ISRAEL; THERAPY; RADIOACTIVITY

27193 (INIS-mf–11406, pp. 18) **Primate model to determine the diagnostic and therapeutic values of hemopoietic growth factors in radiation victims.** Wagemaker, G. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Inst. TNO). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HEMATOPOIETIC SYSTEM/diagnostic techniques; RADIATION INJURIES/biological repair; RETICULOENDOTHELIAL SYSTEM/growth; BLOOD FORMATION; DOSE-RESPONSE RELATIONSHIPS; DRUGS; IN VITRO; MACACUS; PHARMACOLOGY; GROWTH

27194 (INIS-mf–11406, pp. 49) **Some possibilities of the use of classification methods in radiobiology.** Vodicka, I. (Karlova Univ., Hradec Kralove (Czechoslovakia). Lekarska Fakulta); Hanus, J.; Hradil, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DIAGNOSTIC TECHNIQUES/taxonomy; RADIOBIOLOGY/diagnostic techniques; BIOLOGICAL RADIATION EFFECTS; TAXONOMY; NERVE CELLS; RADIOBIOLOGY; SYMPTOMS

27195 (INIS-mf–11406, pp. 107) **Hyperfractionated accelerated radiotherapy of head and neck squamous cell carcinomas based on individual cell kinetic data.** Heil, B. (Muenster Univ. (Germany, F.R.). Radiologische Klinik); Naszaly, A.; Langer, E.; Goehde, W.; Poetter, R.; Esters, P. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HEAD/fractionated irradiation; NECK/fractionated irradiation; CARCINOMAS; HEAD; NECK; RADIATION DOSES; RADIOTHERAPY

27196 (SSA–1988-TS-9, pp. 273-274) **Bone scintigraphy in orthopaedics and traumatology.** Puech, B. (Hopital d'Instruction des Armees Sainte-Anne, 83 - Toulon (FR)); Elizagaray, A.; Lesaint, B.; Cameli, M. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Main indications of bone scintigraphy in Orthopaedics and Traumatology are reviewed. Bone scanning is a very useful complement of radiography to assure or deny a still misunderstood bone lesion, allowing to set faster or to survey more efficiently the therapy.

27197 Mechanistic positron emission tomography studies: demonstration of a deuterium isotope effect in the monoamine oxidase-catalyzed binding of [^{11}C]L-deprenyl in living baboon brain. Fowler, J.S. (Brookhaven National Lab., Upton, NY (USA)); Wolf, A.P.; MacGregor, R.R.; Dewey, S.L.; Logan, J.; Schlyer, D.J.; Langstrom, B. *Journal of Neurochemistry (UK),* 51(5): 1524-1534 (Nov 1988).

The application of positron emission tomography (PET) to the study of biochemical transformations in the living human and animal body requires the development of highly selective radiotracers whose concentrations in tissue provide a record of a discrete metabolic process. L-N-[11C-methyl]Deprenyl ([11C]L-deprenyl), a suicide inactivator of monoamine oxidase (MAO) type B, has been developed as a radiotracer for mapping MAO B in the living human and animal brain. In this investigation, [11C]L-deprenyl (1) and [11C]L-deprenyl-alpha, alpha-2H2 (2) have been compared in three

different baboons by PET measurement of carbon-11 uptake and retention in the brain and the measurement of the amount of unchanged tracer in the arterial plasma over a 90-min time interval. For one baboon, N-[11C-methyl-2H3]L-deprenyl (3) was also studied. Kinetic parameters calculated using a three-compartment model revealed a deuterium isotope effect of 3.8 +/- 1.1. Comparison of the two tracers (1 and 2) in mouse brain demonstrated that deuterium substitution significantly reduced the amount of radioactivity bound to protein. HPLC and GLC analysis of the soluble radioactivity in mouse brain after injection of [11C]L-deprenyl showed the presence of [11C]methamphetamine as a major product along with unidentified labeled products. Sodium dodecyl sulfate-polyacrylamide electrophoresis with carbon-14-labeled L-deprenyl showed that a protein of molecular weight 58,000 was labeled. These results establish that MAO-catalyzed cleavage of the alpha carbon-hydrogen bond on the propargyl group is the rate limiting (or a major rate contributing) step in the retention of carbon-11 in brain and that the in vivo detection of labeled products in brain after the injection of [11C]L-deprenyl provides a record of MAO activity.

5507 Microbiology

Refer also to citation(s) 26203, 26208, 26254, 26258, 27202

5509 Pathology

Refer also to citation(s) 26605, 26711, 27104, 27155, 27314, 27319

5510 Physiological Systems

27198 (AD-A-202690/4/XAB) **Effect of pressure on the release of radioactive glycine and gamma-aminobutyric acid from spinal cord synaptosomes.** Gilman, S.C.; Colton, J.S.; Dutka, A.J. Naval Medical Research Inst., Bethesda, MD (USA). Nov 1987. 9p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Neurochemistry, Vol. 49, No. 5, 1571-1578(Nov 1987).

Exposure to high hydrostatic pressure produces neurological changes referred to as the high-pressure nervous syndrome (HPNS). Manifestations of HPNS include tremor, EEG changes, and convulsions. These symptoms suggest an alteration in synaptic transmission, particularly with inhibitory neural pathways. Because spinal cord transmission has been implicated in HPNS, this study investigated inhibitory neurotransmitter function in the cord at high pressure. Guinea pig spinal cord synaptosome preparations were used to study the effect of compression to 67.7 atmospheres. This study suggest that decreased tonic inhibitory regulation at the level of the spinal cord contributes to the hyperexcitability observed in animals with compression to high pressure.

5520 Public Health

Refer also to citation(s) 26253, 26609, 27064, 27077, 27078, 27079, 27080, 27082, 27083, 27084, 27085, 27086, 27092, 27094, 27095, 27096, 27098, 27100, 27101, 27102, 27103, 27155, 27156, 27322, 27323, 27330

5530 Agriculture and Food Technology

Refer also to citation(s) 27067

27199 (INIS-mf-11406, pp. 77) **Fast neutrons radiolysis of DNA. Studies at the molecular level.** Spotheim-Maurizot, M. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France)); Charlier, M.; Sabatier, R. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353--: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DNA/molecular structure; DNA; FAST NEUTRONS; RADIOLYSIS; STRAND BREAKS

27200 (INIS-mf-11406, pp. 106) **Choice of dose for radiation sterilization.** Jacobs, G.P. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353--: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOSTERILIZATION/medical supplies; RADIOSTERILIZATION/radiation doses; GAMMA RADIATION; ORGANIC POLYMERS; RADIOSTERILIZATION

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 26844, 26858, 26859, 27179, 27193, 27199

27201 (AD-A-202440/4/XAB) **Goodness-of-fit tests for additive-hazards and proportional-hazards models. Technical report.** McKeague, I.W.; Utikal, K.J. Florida State Univ., Tallahassee, FL (USA). Dept. of Statistics. Oct 1988. 18p. (FSU-STATISTICS-M--793). Available from NTIS, PC A03/MF A01.

Additive-hazards and proportional-hazards regression models used in the analysis of censored survival data can give substantially different results. For instance, in connection with a study of cancer mortality among Japanese atomic bomb survivors, Muirhead and Darby (1987) have noted that the two models give substantially different estimates of the age-specific probability that an individual will develop radiation-induced cancer. Muirhead and Darby introduced a generalized parametric model which contains parametric additive-hazards and proportional-hazards models as special cases. The goodness-of-fit of each model is then obtained by comparing with the best-fitting model within the generalized family, allowing the two special models to be treated on an equal footing. The purpose of this paper is to develop formal goodness-of-fit tests for the models of Aalen and Cox in which each model is compared on an equal footing with the best-fitting fully nonparametric model.

27202 (AD-A-202515/3/XAB) **Alterations in phosphate metabolism during cellular recovery of radiation damage in yeast.** Holahan, P.K.; Knizner, S.A.; Gabriel, C.M.; Swenberg, C.E. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1988. 20p. (AFRRI-SR--88-22). Available from NTIS, PC A03/MF A01.

Pub. in International Jnl. of Radiation, Vol. 54, No. 4, 545-562(1988).

Alterations were examined in phosphate pools during cellular recovery from radiation damage in intact, wild-type diploid yeast cells using phosphorus 31 nuclear magnetic resonance (NMR) spectroscopy. Concurrent cell survival analysis was determined following exposure to cobalt 60 gamma radiation. Cells held in citrate-buffered saline (CBS) showed increased survival with increasing time after irradiation (liquid holding recovery, LHR) with no further recovery beyond 48 h. Addition of 100 mmol/cu. dm glucose to the recovery medium resulted in greater recovery. In the presence of 5 mmol/cu. dm 2-deoxyglucose (2-DG), LHR was completely inhibited. ATP was observable by NMR only when glucose was present in the recovery medium. In control cells, ATP concentrations increased and plateaued with increasing recovery time. With increasing radiation dose, the increase in ATP was of lesser magnitude, and after 2000 Gy no increase was observed. The observations suggest that either the production of ATP in irradiated cells is suppressed, or there is enhanced ATP utilization for repair of radiation damage. In CBS with 100 mmol/cu. dm glucose, a dose-dependent decrease in polyphosphate (polyP) was detectable with no concurrent increase in inorganic phosphate (p sub i). When 2-DG was present in the recovery medium, polyP decreased, but there was a simultaneous increase in p sub i with increasing radiation dose and recovery time. This suggests that the polyP are hydrolyzed as a source of phosphates for repair of radiation damage.

27203 (AD-A-202516/1/XAB) **Prospects for management of gastrointestinal injury associated with the acute radiation syndrome.** Dubois, A.; Walker, R.I. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). Aug 1988. 10p. (AFRRI-SR-88-21). Available from NTIS, PC A02/MF A01.

Pub. in Gastroenterology, Vol. 95, No. 2, 500-507(Aug 1988).

The effect of total-body ionizing radiation on the digestive tract is dose-dependent and time-dependent. At low doses (1.5 Gy), one observes only a short prodromal syndrome consisting of nausea, vomiting, and gastric suppression. At doses>6 Gy, the prodromal syndrome is more marked, and it is followed after a 2-5-day remission period by a subacute syndrome, characterized by diarrhea and hematochezia. This gastrointestinal syndrome is superimposed onto a radiation-induced bone marrow suppression. The combination of intestinal and hemopoietic syndromes results in dehydration, anemia, and infection, leading eventually to irreversible shock and death. The treatment of prodromal symptoms is based on the administration of antiemetics and gastrokinetics, although an effective treatment devoid of side effects is not yet available for human therapy. The treatment of the gastrointestinal subacute syndrome remains difficult and unsuccessful after exposure to total-body doses >8-10 Gy. Supportive therapy to prevent infection and dehydration may be effective if restoration or repopulation of the intestinal and bone marrow stem cells does occur. In addition, bone marrow transplantation may improve the prospect of treating the hemopoietic syndrome, although the experience gained in Chernobyl suggests that this treatment is difficult to apply in the case of nuclear accidents. Administration of radioprotectants before irradiation decreases damage to healthy cells, while not protecting cancerous tissues. In the future, stimulation of gastrointestinal and hemopoietic progenitor cells may be possible using cell growth regulators, but much remains to be done to improve the treatment of radiation damage to the gastrointestinal tract.

27204 (AD-A-202971/8/XAB) **In vivo effects and interactions of recombinant interleukin 1 and tumor-necrosis factor in radioprotection and induction of fibrinogen. Scientific report.** Neta, R. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1988. 7p. (AFRRI-SR-88-26). Available from NTIS, PC A02/MF A01.

Pub. in Tumor Necrosis Factor/Cachectin and Related Cytokines International Conference on Tumor Necrosis Factor and Related Cytotoxins, 246-251(1988).

Although interleukin 1 (IL-1) and tumor necrosis factor (TNF) are both produced by stimulated macrophage-monocytes, they are molecularly distinct, act via separate receptors, but show striking resemblance in their biological activity. Both cytokines are pyrogenic, induce colony-stimulating factor and acute-phase proteins, activate neutrophils, reduce cytochrome P-450 functions, and inhibit lipoprotein lipase. Furthermore, IL-1 and TNF have been reported to induce the release of one another. Because of this mutual induction, the relative contribution of IL-1 or TNF to the induction of a given activity becomes difficult to establish. In an attempt to determine whether these two cytokines act independently, the effect of administrating them separately or in combination is compared on the radioprotection and on the induction of an acute-phase reactant - fibrinogen. IL-1 and TNF have synergistic effects on radioprotection and on the levels of circulating fibrinogen.

27205 (AD-A-202972/6/XAB) **Rapid communication: stochastic model of free-radical yields in oriented DNA exposed to densely ionizing radiation at 77K. Scientific report.** Miller, J.H.; Wilson, W.E.; Swenberg, C.E.; Myers, L.S.; Charlton, D.E. Pacific Northwest Lab., Richland, WA (USA). 1988. 8p. Available from NTIS, PC A02/MF A01.

Pub. in International Jnl. of Radiation Biology, Vol. 53, No. 6, 901-907(1988).

Monte Carlo simulation techniques were used to calculate the probability that thymine radical anions, formed by the slowing-down of high-energy protons in oriented DNA, will undergo a secondary protonation reaction. By assuming a large asymmetry in the thermal conductivity of oriented DNA fibers, a significant enhancement is predicted of protonation of thymine radical anions when the proton flux is incident on the sample parallel to the orientation of the DNA. These results are in qualitative agreement with experimental data on the production of Thymine radicals when oriented DNA is exposed to fast neutrons.

27206 (AD-A-203084/9/XAB) **Effects of dithiothreitol, a sulfhydryl reducing agent, on CA1 pyramidal cells of the guinea pig hippocampus in vitro.** Tolliver, J.M.; Pellmar, T.C. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1988. 9p. (AFRRI-SR-88-28). Available from NTIS, PC A02/MF A01.

The radioprotectant, dithiothreitol (DTT) has been shown to increase excitability in the hippocampal slice preparation. In the present study, intracellular recording techniques were used to further examine the actions of DTT. Electrophysiological recordings from CA1 pyramidal cells were examined prior to, during and after DTT exposure. DTT caused a small depolarization without altering membrane resistance. DTT-induced spontaneous firing and occasional burst firing in normally silent neurons. These effects were accompanied by a reduction in spike frequency adaptation but no change in the after hyperpolarization following a train of action potentials. Following DTT exposure, orthodromic stimulation produced multiple firing. subthreshold excitatory postsynaptic potentials (EPSPs) were significantly prolonged. Isolating the CA1 subfield, attenuated the prolongation of the EPSP by DTT. Recurrent inhibitory postsynaptic potentials were unaffected by DTT. The actions of DTT are likely to result from DTT-induced reduction of disulfide bonds since the reduced form of DTT does not cause a similar hyperexcitability.

27207 (AD-A-203085/6/XAB) **Cytokines in therapy of radiation injury.** Neta, R.; Oppenheim, J.J. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). Sep 1988. 4p. (AFRRI-SR-88-27). Available from NTIS, PC A02/MF A01.

Pub. in Blood, Vol. 72, No. 3, 1093-1095(Sep 1988).

Repeated injections or infusion of hematopoietic growth factors, such as interleukin-3 (IL-3), granulocyte macrophage-colony stimulating factor (GM-CSF), or granulocyte-colony stimulating factor (G-CSF), accelerate restoration of hematopoiesis in animals compromised by sublethal doses of cytotoxic drugs or irradiation. Previous work by the investigators has shown the IL-1 induced circulating CSF in normal mice and, when used after sublethal irradiation, accelerated the recovery of endogenous splenic colonies. Therefore, IL-1, as well as IFN-gamma, tumor necrosis factor (TNF), G-CSF, and GM-CSF, were evaluated as potential therapeutic agents in irradiated C3H-HeN mice. A single intraperitoneal injection, administered within three hours after a lethal dose (LD) 95/30 of irradiation that would kill 95% of mice within 30 days, protected in a dose-dependent manner up to 100% of mice from radiation-induced death due to hematopoietic syndrome. Significant therapeutic effects were also achieved with a single dose of IFN-gamma or of TNF. In contrast, GM-CSF and G-CSF, administered shortly after irradiation, had no effect in the doses used on mice survival.

27208 (DOE/NV/10574-3) **Fission track analysis of Pu in small specimens of biological material: Technical progress report, August 1, 1987-July 31, 1988.** Wrenn, M.E. Utah Univ., Salt Lake City, UT (USA). Coll. of Medicine. 30 Oct 1988. 29p. DOE Contract AC08-86NV10574. Order Number DE89009924/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this research is to develop a highly specific and ultrasensitive method capable of detecting 100 aCi/liter of ^{239}Pu in human urine. The method using neutron induced fission track analysis is to be made free of interference from uranium, the only naturally occurring element with an isotope which fissions with thermal neutrons. A simplified flow diagram for the method is shown in Figure 1. Briefly ^{239}Pu is coprecipitated quantitatively from urine with rhodozonic acid. The precipitate containing the ^{239}Pu is dissolved in HCl and is sequentially passed through two ion exchange columns and reduced in volume. The element is then deposited in a circular area on a thick polycarbonate detector and a thinner detector is placed over the circular deposit. The plastic detectors are then irradiated to a high thermal neutron fluence in a research reactor. The detectors are etched in a caustic solution for controlled times and temperatures in order to develop the fission tracks. Images of tracks are formed both on the thin and thick plastic detectors. Total tracks in the thinner detector are measured with a locally developed spark counter and in the thick plastic are measured by counting with a microscope. The results will be made quantitative by constructing a calibration curve for ^{239}Pu. 3 refs., 9 figs., 3 tabs.

27209 (EGG-BNCT–8353-Vol.3-No.2) **PBF/BNCT Program for cancer treatment: Bulletin.** Dorn, R.V. III; Ackermann, A.L. (ed.). EG and G Idaho, Inc., Idaho Falls, ID (USA). Feb 1989. 45p. DOE Contract AC07-76ID01570. Order Number DE89010984/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Highlights of the PBF/BNCT Program during January include progress within the areas of: gross boron analysis in tissue blood and urine (large numbers of biological samples continue to be analyzed), analytical methodologies development for BSH (sodium borocaptate) purity determination, boron microscopic (subcellular) analytical development, noninvasive boron quantification determination, and dosimetry.

27210 (INIS-BR–1458, pp. 173) **Interpretation of the increase in biological effectiveness observed for some ionizing radiation at low dose-rates.** Watt, D.E. (Saint Andrews Univ. (UK)); Sykes, C.E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

IONIZING RADIATIONS/biological radiation effects; DOSE RATES; RADIATION DOSES

27211 (INIS-BR–1458, pp. 147) **Radiobiological effects of high-let particles.** Chaterjee, A. (Lawrence Berkeley Lab., CA (USA)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DNA/biological radiation effects; DNA/heavy ions; DNA/let; HEAVY IONS/dna; HEAVY IONS/energy absorption; DNA; LET

27212 (INIS-BR–1458, pp. 174) **1-SPC as a model for studying γ-ray induces damage in lipid membranes: 1) DSC and EPR results on non irradiated samples.** Giori, C. (Parma Univ. (Italy). Inst. de Scienze Fisiche); Schianchi, G.; Erriu, G.; Onnis, S.; Randaccio, P.; Zucca, N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LIPIDS/chemical radiation effects; LIPIDS/gamma radiation; BIOLOGICAL RECOVERY; ELECTRON SPIN RESONANCE; IRRADIATION; LIPIDS; LIPOSOMES; WATER

27213 (INIS-BR–1458, pp. 175) **1. SPC as a model for studying γ-rays induced damage in lipid membranes. 2. DSC and EPR results on irradiated samples.** Erriu, G. (Cagliari Univ. (Italy). Ist. di Fisica Medica); Ladu, M.; Onnis, S.; Randaccio, P.; Zucca, N.; Giori, G.; Schianchi, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LIPIDS/chemical radiation effects; LIPIDS/gamma radiation; ELECTRON SPIN RESONANCE; IRRADIATION; LIPIDS; TEMPERATURE DEPENDENCE

27214 (INIS-BR–1458, pp. 176) **Mechanisms of interaction high-enthalpy plasma flow and radiation with biological tissues.** Brekhov, Y.I. (Moscow Bauman Higher Technical School (USSR)); Pekshev, A.V.; Protasov, Y.S.; Suslov, N.I.; Tartynsky, S.I. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LIVER/tissues; SPLEEN/tissues; TISSUES/laser radiation; TISSUES/morphological changes; LIVER; TISSUES; SPLEEN; SURFACES; TEMPERATURE DISTRIBUTION; THERMAL CONDUCTIVITY

27215 (INIS-BR–1458, pp. 183) **Sequential exposures of mixed beams of high and low LET (Linear Energy Transfer) radiations: their possible mode of interactions and consequences.** Datta, S. (Louisiana State Univ., Shreveport (USA)); Datta, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CHO CELLS/biological radiation effects; CHO CELLS/let; CHO CELLS/sequential scanning; ALPHA BEAMS; LET; IONIZING RADIATIONS; IRRADIATION

27216 (INIS-mf–11406) **European Society for Radiation Biology 21. annual meeting. Program and abstracts.** European Society for Radiation Biology, Liege (Belgium). 1988. 141p. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The volume contains about 100 abstracts of lectures presented to the conference covering a large variety of topics like: Radiobiology as a base for radiotherapy, radiation carcinogenesis and cellular effects, late and secondary effects of radiotherapy, radioprotection and radiosensitization, heavy ions in radiobiology and space research, microdosimetry and biological dosimetry, radiation effects on the mature and the developing central nervous system, DNA damage and repair and cellular mutations, the imact of radiation on the environment, free radicals in radiation biology.

27217 (INIS-mf–11406 vp.) **Test of hypothesis that each unrepaired DSB becomes a chromosome aberration.** Ostashevsky, J.Y. (Health Science Center at Brooklyn, NY (USA)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Published in summary form only.

27218 (INIS-mf–11406 vp.) **New perspectives in radioprotection.** Maisin, J.R. (UCL - Faculte de Medicine, Bruxelles (Belgium)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Published in summary form only.

27219 (INIS-mf–11406 vp.) **Stabilization of enhanced radiosensitivity of bacillus megaterium spores by pretreatment of diethylmaleate and diamide.** Gazso, L.G. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Dam, A.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Published in summary form only.

27220 (INIS-mf–11406 vp.) **Effect of hyperthermia (42-45^0) on repair of radiation induced DNA strand breaks.** Dikomey, E. (Hamburg Univ. (Germany, F.R.). Inst. fuer Biophysik und Strahlenbiologie); Franzke, J.; Jung, H. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Published in summary form only.

27221 (INIS-mf–11406, pp. 83) **Significance of changes in thymidine metabolism and nucleotide pools for salvage DNA**

synthesis following in vivo x-irradiation of ascites tumour. Skog, S. (Karolinska Inst., Stockholm (Sweden)); Tribukait, B.; Sundius, K. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ASCITES TUMOR CELLS/metabolism; METABOLISM; DNA REPLICATION; IN VIVO; THYMIDINE; X RADIATION

27222 (INIS-mf–11406, pp. 84) **Dose-response relationship for x-ray induced chromosome aberrations in mouse spermatogonial stem cells after inhibition of ADP ribosylation.** Buul, P.P.W. van (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHROMOSOMAL ABERRATIONS/dose-response relationships; STEM CELLS/chromosomal aberrations; ADP; CELL KILLING; INHIBITION; MICE; RIBOSE; SPERMATOGONIA; TESTES; X RADIATION

27223 (INIS-mf–11406, pp. 87) **Repair of hypersensitivity of ataxia-telangiecstasia fibroblasts to the radiomimetic drug neocarcinostatin by transfection with mouse DNA.** Becker, Y. (Hebrew Univ., Faculty of Medicine, Jerusalem (Israel). Dept. of Molecular Virology); Asher, Y.; Tabor, E. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MICE/dna repair; TELANGIECTASIS/genetic radiation effects; FIBROBLASTS; MICE; NEOCARCINOSTATIN; RADIOSENSITIVITY; TELANGIECTASIS

27224 (INIS-mf–11406, pp. 13) **Development of malignancy in mice after total lymphoid irradiation (TLI).** Covelli, V. (ENEA, CRE-Casaccia, Rome (Italy). Laboratory of Pathology); Di Majo, V.; Coppola, M.; Rebessi, S. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LYMPHOCYTES/fractionated irradiation; MICE/fractionated irradiation; DELAYED RADIATION EFFECTS; LYMPHOCYTES; LYMPHOMAS; MICE; RADIATION DOSES; X RADIATION

27225 (INIS-mf–11406, pp. 17) **Recovery kinetics of jejunal crypt stem cells in mice.** Huczkowski, J. (Mount Vernon Hospital, Northwood (UK). Gray Lab.); Joiner, M.C.; Trott, K.R. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SMALL INTESTINE/biological recovery; STEM CELLS/biological recovery; BIOCHEMICAL REACTION KINETICS; DOSE RATES; FRACTIONATED IRRADIATION; MICE; RADIOTHERAPY

27226 (INIS-mf–11406, pp. 21) **Chemical protection against ionizing radiation. A survey.** Vos, E. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab.). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIATION PROTECTION/radioprotective substances; GLUTATHIONE; HYDROGEN TRANSFER; IONIZING RADIATIONS; MICE; RADIOSENSITIVITY; RATS; THIOLS

27227 (INIS-mf–11406, pp. 25) **Behavior and radioprotective efficacy of mice treated with a combination of WR-2721 and 16, 16 dimethyl prostaglandin E_2.** Landauer, M.R. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)); Walden, T.L.; Davis, H.D. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PROSTAGLANDINS/radioprotective substances; RADIOPROTECTIVE SUBSTANCES/efficiency; THIOIC ACIDS/radioprotective substances; MICE; PROSTAGLANDINS; RADIATION PROTECTION; EFFICIENCY

27228 (INIS-mf–11406, pp. 55) **Late, carcinogenic effect of prenatal neutron irradiation of mice.** Antal, S. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Unger, E.; Fonagy, A.; Hidvegi, E.J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PRENATAL IRRADIATION/delayed radiation effects; CARCINOGENESIS; MICE; NEUTRONS; WHOLE-BODY IRRADIATION

27229 (INIS-mf–11406, pp. 59) **Physiological aspects of the radiation effect on the vasculature of the mature central nervous system.** Keyeux, A. (Louvin Univ., Brussels (Belgium). Ecole de Medicine). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BLOOD FLOW/biological radiation effects; CENTRAL NERVOUS SYSTEM/biological radiation effects; BLOOD-BRAIN BARRIER; PATHOLOGICAL CHANGES; PHYSIOLOGY; RATS

27230 (INIS-mf–11406, pp. 60) **Use of a radioprotector to spare the microcirculation in the CNS.** Plotnikova, E.D. (AN SSSR, Moscow (USSR). Inst. Biologicheskoj Fiziki). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BLOOD VESSELS/radiation protection; BRAIN/necrosis; GAMMAPHOS; BRAIN; NECROSIS; DELAYED RADIATION EFFECTS; GAMMAPHOS

27231 (INIS-mf–11406, pp. 62) **Phases of enhanced radiosensitivity during CNS-development-initial effects.** Heinzmann, U. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Pathologie). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CENTRAL NERVOUS SYSTEM/radiosensitivity; BIOLOGICAL RADIATION EFFECTS; RADIOSENSITIVITY; EMBRYONIC CELLS; MICE; RATS

27232 (INIS-mf–11406, pp. 64) **Inhibition of protein synthesis in mouse brain after fission neutron irradiation in utero.**

Vogel, H.H. Jr (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Fogany, A.; Antal, S.; Holland, J.; Korosi, L.; Hidvegi, E.J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOSYNTHESIS/inhibition; PRENATAL IRRADIATION/mice; PROTEINS/prenatal irradiation; BIOSYNTHESIS; INHIBITION; BRAIN; FISSION NEUTRONS; MICE; PROTEINS

27233 (INIS-mf–11406, pp. 75) **Carcinogen and radiation-induced DNA single strand breaks (SSB) in vervet monkey lymphocytes.** Potgieter, H.C. (Pretoria Univ. (South Africa)); Thierry, H.; Louw, W.K.A. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL MODELS/tumor cells; TUMOR CELLS/monkeys; CARCINOGENS; DNA; DOSE-RESPONSE RELATIONSHIPS; GAMMA RADIATION; LYMPHOCYTES; STRAND BREAKS; MONKEYS; TUMOR PROMOTERS

27234 (INIS-mf–11406, pp. 95) **Rn/Ra ratio in rat skeleton.** Szerbin, P. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE TISSUES/isotope ratio; SKELETON/isotope ratio; RADIATION DOSES; RADIUM 226; RADON; RATS; SKELETON

27235 (INIS-mf–11406, pp. 3) **Optimal time interval between myeloablative whole body irradiation and reconstitution with syngeneic bone marrow graft.** Weiss, L. (Hadassah Univ. Hospital, Jerusalem (Israel). Dept. of Bone Marrow Transplantation and Cancer Immunobiology); Ashkenazi, Y.J.; Bullorsky, E.; Slavin, S. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE MARROW/whole-body irradiation; GRAFTS/bone marrow; GRAFTS; OPTIMIZATION; RADIOIMMUNOLOGY; RADIOTHERAPY; TIME DEPENDENCE

27236 (INIS-mf–11406, pp. 4) **Modification of radiation response by hypoxyradiotherapy.** Neumeister, K. (Zentralinstitut fuer Radiologie, Karl-Marx-Stadt (German Democratic Republic)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOTHERAPY/dose-response relationships; NEOPLASMS; OXYGEN; RADIATION PROTECTION; RADIOTHERAPY; TISSUES

27237 (INIS-mf–11406, pp. 12) **Use of linear quadratic model and alpha/beta value for late complications in radiotherapy for head and neck tumors.** Maciejewski, B. (Instytut Onkologii, Gliwice (Poland)); Withers, H.R.; Taylor, J.M.G. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NECK/radiotherapy; NEOPLASMS/delayed radiation effects; ORAL CAVITY/radiotherapy; CORRELATIONS; FRACTIONATED IRRADIATION; HEAD; NECK; RADIOTHERAPY; NEOPLASMS

27238 (INIS-mf–11406, pp. 14) **Cytogenetic investigations on radiation damage in bone marrow and peripheral blood of leukemic patients after bone marrow transplantation.** Heinze, B. (Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Technische Thermodynamik, Hydraulik und Energetik); Arnold, R.; Kratt, E.; Hertenstein, B.; Heit, W.; Fliender, T.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE MARROW/radiation injuries; LEUKEMIA/radiation injuries; TRANSPLANTS/radiation injuries; BLOOD; CYTOLOGY; GENETICS; LEUKEMIA; TIME DEPENDENCE; TRANSPLANTS; WHOLE-BODY IRRADIATION

27239 (INIS-mf–11406, pp. 32) **Topical treatment of radiation induced dermatitis with cysteine analogs.** Morgan, L.R. (Mercy Hospital, New Orleans, LA (USA)); Hooper, C.L.; Judge, K.W.; Hayman, M.H.; Merlin, C.S. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIODERMATITIS/healing; CYSTEINE; MICE; RADIODERMATITIS; HEALING

27240 (INIS-mf–11406, pp. 33) **Chemical manipulation of tissue oxygenation to improve cancer therapy.** Guichard, M. (Institut Gustav Roussy, 94 - Villejuif (France). Lab. de Radiobiologie Cellulaire). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NEOPLASMS/radiosensitizers; ANOXIA; NEOPLASMS; RADIOSENSITIZERS; RADIOSENSITIVITY; RADIOTHERAPY; TISSUES

27241 (INIS-mf–11406, pp. 61) **Introductory review of radiation effects on the developing CNS.** Schmahl, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Pathologie). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL RADIATION EFFECTS/central nervous system; CENTRAL NERVOUS SYSTEM/biological pathways; RADIOSENSITIVITY

27242 (INIS-mf–11406, pp. 96) **Combination of mucolytic agent and DTPA as a new possibility for decorporation of inhaled 144-Ce in emphysematous rats.** Namenyi, J. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Gachalyi, A.; Szegedi, I. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

EMPHYSEMA/radionuclide kinetics; LUNG CLEARANCE/cerium 144; DTPA; EMPHYSEMA; RATS

27243 (INIS-mf–11406, pp. 97) **Effects of pre-existing emphysema and cigarette smoking on the retention of inhaled**

144-CeO_2 in rats. Namenyi, J. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Mauderly, J.L.; Lundgren, D.L.; Chen, B.T. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CERIUM OXIDES/retention; CERIUM 144/retention; EMPHYSEMA/radionuclide kinetics; TOBACCO SMOKES/radionuclide kinetics; RETENTION; COMPARATIVE EVALUATIONS; DOSE-RESPONSE RELATIONSHIPS; EMPHYSEMA; LUNG CLEARANCE; LUNGS; RATS

27244 (INIS-mf–11406, pp. 5) **Synthesis and phosphorylation of proteins in P388 lymphoid tumor cells on hyperthermia treatment and x-irradiation.** Bagi, G. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Hidvegi, E.J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PROTEINS/phosphorylation; BIOSYNTHESIS; HYPERTHERMIA; IRRADIATION; LYMPHOCYTES; LYMPHOMAS; PROTEINS; PHOSPHORYLATION; TUMOR CELLS; X RADIATION

27245 (INIS-mf–11406, pp. 7) **Multiple fractions of gamma rays induced resistance to cis-dichlorodiammine platinum(II) and methotrexate in human HeLa cells.** Maja, O. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Sanja, P. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

FRACTIONATED IRRADIATION/cytochemistry; HELA CELLS/sensitivity; CYTOCHEMISTRY; GAMMA RADIATION; SENSITIVITY; IN VITRO; METHOTREXATE; TOXICITY; ULTRAVIOLET RADIATION

27246 (INIS-mf–11406, pp. 8) **Interdigitating dendritic cells may be involved in the prevention of x-ray induced thymoma in mice: Theoretical considerations.** Becker, Y. (Hebrew Univ. Faculty of Medicine, Jerusalem (Israel). Dept. of Molecular Virology). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LEUKEMIA/inhibition; MICE/leukemia; THYMUS CELLS/leukemia; BONE MARROW CELLS; FRACTIONATED IRRADIATION; LEUKEMIA; INHIBITION; MICE; X RADIATION

27247 (INIS-mf–11406, pp. 9) **Effect of lead shielding or bone marrow injection on x-irradiation on thymic dendritic cells in C37BL/6 mice. Experimental results.** Sprecher, E. (Hebrew Univ., Jerusalem (Israel). Faculty of Medicine); Yefonof, E.; Giloh, H.; Becker, Y. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MICE/leukemogenesis; THYMUS CELLS/irradiation; BIOLOGICAL SHIELDING; BONE MARROW; MICE; LEUKEMOGENESIS; IRRADIATION; X RADIATION

27248 (INIS-mf–11406, pp. 10) **IL-2 reduces clearly effect of radiation on NK cells; Interferons are less active.** Hietanen, T. (Tampere Univ. Central Hospital (Finland). Dept. of Radiotherapy); Pitkaenen, M.; Aran, R.K.; Leinikki, P. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL KILLING/radiosensitivity; RESPONSE MODIFYING FACTORS/cell killing; TUMOR CELLS/cell killing; BIOLOGICAL RADIATION EFFECTS; RADIOSENSITIVITY; IMMUNITY

27249 (INIS-mf–11406, pp. 11) **Effects of 2.45 GHz microwave irradiation on viability and metastatic ability of P388 lymphoid tumor cells.** Holland, J. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Mangel, G.; Szkladanyi, A.; Szabo, L.D. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LYMPHOMAS/viability; TUMOR CELLS/microwave radiation; BIOLOGICAL RADIATION EFFECTS; LYMPHOCYTES; LYMPHOMAS; VIABILITY; METASTASES

27250 (INIS-mf–11406, pp. 15) **Strength of healing wounds in irradiated skin as an assay of late dermal radiation response.** Gorodetsky, R. (Hebrew Univ., Jerusalem (Israel). Hadassah Medical School); Mou, X.; Taylor, J.; Withers, H.R. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKIN/delayed radiation effects; WOUNDS/delayed radiation effects; FRACTIONATED IRRADIATION; HEALING; MICE; SKIN; WOUNDS; X RADIATION

27251 (INIS-mf–11406, pp. 23) **Anticarcinogenesis and improved radioprotection by enhancement of DNA repair.** Riklis, E. (Israel Atomic Energy Commission, Beersheba (Israel). Nuclear Research Center-Negev); Kol, R.; Green, M.; Prager, A.; Marko, R.; Mintsberg, M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIATION PROTECTION/dna repair; RADIOPROTECTIVE SUBSTANCES/carcinogenesis; NICOTINAMIDE; CARCINOGENESIS

27252 (INIS-mf–11406, pp. 24) **Cellular thiols and post-irradiation repair of damage.** Edgren, M. (Karolinska Inst., Stockholm (Sweden). Dept. of Tumor Biology); Revesz, L. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

POST-IRRADIATION THERAPY/dna repair; THIOLS/post-irradiation therapy; AEROBIC CONDITIONS; FIBROBLASTS; GLUTATHIONE; THIOLS

27253 (INIS-mf–11406, pp. 26) **Influence of metal ions and microsomes on oxygen uptake by WR-1065 in vitro.** Kumar, K.S. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)); Weiss, J.F. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOPROTECTIVE SUBSTANCES/copper ions; RADIOPROTECTIVE SUBSTANCES/selenium ions; IN VITRO; LIVER; MICE; MICROSOMES; OXYGEN; THIOIC ACIDS; THIOLS

27254 (INIS-mf–11406, pp. 27) **Effect of cysteamine and mercaptoethanol on the survival of γ-irradiated E.Coli K12 strains in the logarithmic and the stationary growth phase in the presence of oxygen.** Hartke, A. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Huelswede, J.W.; Schulte-Frohlinde, D. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ESCHERICHIA COLI/survival curves; MEA/survival curves; BIOLOGICAL REPAIR; ENZYME ACTIVITY; GAMMA RADIATION; GROWTH; MEA; OXYGEN

27255 (INIS-mf–11406, pp. 28) **Effect of irradiation and radioprotective compound on mitochondrial glutathione content.** Bodo, K. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Ronai, E.; Horvath, Gy. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

GLUTATHIONE/radiosensitivity; MITOCHONDRIA/whole-body irradiation; GLUTATHIONE; RADIOSENSITIVITY; IN VITRO; LIVER; MITOCHONDRIA; QUANTITY RATIO; RATS; THIOIC ACIDS; THIOLS

27256 (INIS-mf–11406, pp. 29) **Comparative studies of nonthiol and thiol containing radioprotective compounds of the lipid peroxidation of liver homogenate and mitochondria.** Ronai, E. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Bodo, K.; Horvath, Gy. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HOMOGENATES/oxidation; MITOCHONDRIA/oxidation; RADIOPROTECTIVE SUBSTANCES/comparative evaluations; HOMOGENATES; OXIDATION; IN VITRO; INHIBITION; LIPIDS; LIVER; MITOCHONDRIA; THIOLS

27257 (INIS-mf–11406, pp. 30) **Potential role of SH groups in the radiosensitivity of adenylate cyclase.** Takats, A. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Bertok, L. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CYCLASES/radiosensitivity; SH-PROTEINASES/radiosensitivity; CYCLASES; RADIOSENSITIVITY; SH-PROTEINASES

27258 (INIS-mf–11406, pp. 31) **Dephosphorylation of WR-2721: Effect of radiation protection and DEM-sensitization at different oxygen concentrations.** Dam, A.M. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Gazso, G.L. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIATION PROTECTION/oxygen; GLUTATHIONE; PHOSPHORYLATION; QUANTITY RATIO; OXYGEN; SENSITIZERS; THIOIC ACIDS; THIOLS

27259 (INIS-mf–11406, pp. 34) **Combination of dibromodulcitol with x-irradiation increases the lifespan of mice bearing experimental brain tumors.** Hidvegi, E.J. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Perlaky, L.; Gazso, L.; Institoris, L.; Afra, D. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

GLIOMAS/radiosensitizers; GLIOMAS/radiotherapy; GLIOMAS; RADIOSENSITIZERS; RADIOTHERAPY; MICE; SURVIVAL TIME; TRANSPLANTS; X RADIATION

27260 (INIS-mf–11406, pp. 35) **Effects of imidazole derivatives in the survival of ^{60}Co irradiated mice.** Villavicencio, A.L.C.H. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Div. de Radiobiologia); Lucia del M, N. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

IMIDAZOLES/survival curves; RADIOSENSITIZERS/survival curves; ANIMAL CELLS; IMIDAZOLES; IRRADIATION; MICE; NEOPLASMS; RADIOSENSITIVITY; RADIOSENSITIZERS; RADIOTHERAPY

27261 (INIS-mf–11406, pp. 37) **Radiosensitivity effect of a new nitroquinoline derivation.** Varga, L.P. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Berenyi, E. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

QUINOLINES/radiosensitizers; RADIOSENSITIZERS/quinolines; SURVIVAL CURVES/quinolines; ANIMAL CELLS; NITRO COMPOUNDS; QUINOLINES; RADIOSENSITIZERS; TOXICITY

27262 (INIS-mf–11406, pp. 38) **Comparison of the effects of heavy ions at the physical, chemical and biological level.** Kraft, G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Ritter, S.; Stanton, J.A.; Scholz, M.; Kraft-Weyrather, W.; Schmidt, S.; Schmidt-Bocking, H. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL MODELS/comparative evaluations; LET/heavy ions; CHROMOSOMAL ABERRATIONS; CROSS SECTIONS; DNA; INACTIVATION; LET; STRAND BREAKS

27263 (INIS-mf–11406, pp. 39) **Biological role of cosmic ray HZE particles: The need for effect particle correlation concepts.** Horneck, G. (DFVLR Inst. for Aerospace Medicine, Koeln (Germany, F.R.). Div. of Biophysics). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL RADIATION EFFECTS/cosmic radiation; CORRELATIONS; SPACE

27264 (INIS-mf–11406, pp. 41) **Neoplastic transformation, cell inactivation and micronucleus induction by 5.4 KeV x rays.**

Hieber, L. (Wuerzburg Univ. (Germany, F.R.). Inst. fuer Medizinische Strahlenkunde); Roos, H.; Wachsmann, M.; Ponsel, G.; Trutschler, K.; Fenn, S.; Fromke, E.; Kellerer, A.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL TRANSFORMATIONS/comparative evaluations; ALPHA PARTICLES; GAMMA RADIATION; INACTIVATION; KEV RANGE 01-10; X RADIATION

27265 (INIS-mf–11406, pp. 42) **Characterization of syrian hamster embryo cells neoplastically transformed by 8 MeV/u carbon ions.** Hieber, L. (Wuerzburg Univ. (Germany, F.R.). Inst. fuer Medizinische Strahlenkunde); Trutschler, K.; Ponsel, G.; Kellerer, A.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL TRANSFORMATIONS/cloning; EMBRYOS/cell transformations; ANIMAL CELLS; CLONING; EMBRYOS; EXTERNAL IRRADIATION; HAMSTERS; MEV RANGE 01-10; PLAQUE FORMATION

27266 (INIS-mf–11406, pp. 43) **DNA strand break induction, rejoining and repair in cultured mammalian cells after irradiation with accelerated heavy charged particles.** Rink, H. (Institute of Radiation Biology, Bonn (Germany, F.R.)); Heilman, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/dna repair; ANIMAL CELLS/strand breaks; CELL CULTURES; DNA; EXTERNAL IRRADIATION; HEAVY IONS

27267 (INIS-mf–11406, pp. 44) **Mutation induction in mammalian cells by very heavy ions.** Kranert, T. (Giessen Univ. (Germany, F.R.). Strahlenzentrum); Schneider, E.; Kiefer, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/mutagenesis; MUTAGENESIS/heavy ions; MUTAGENESIS; EXTERNAL IRRADIATION; FIBROBLASTS; HAMSTERS; LET; LUNGS; SURVIVAL CURVES

27268 (INIS-mf–11406, pp. 46) **Microdosimetric constraints on specific adaption mechanisms to ionizing radiation in mammalian cells.** Burkart, W. (Paul Schrerer Institute, Wurenlingen (Switzerland). Dept. of Radiation Hygiene); Vijayalaxmi. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/biological repair; DOSE-RESPONSE RELATIONSHIPS; IONIZING RADIATIONS; LOW DOSE IRRADIATION; MAMMALS; MICRODOSIMETRY

27269 (INIS-mf–11406, pp. 48) **Micronucleus assay as a means to detect differential sensitivity to radiation.** Huber, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Abt. fuer Strahlenbiologie); Bauchinger, M.; Braselmann, H. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CYTOLOGICAL TECHNIQUES/radiosensitivity; RADIOSENSITIVITY/comparative evaluations; CHROMOSOMAL ABERRATIONS; RADIOSENSITIVITY; GAMMA RADIATION; LYMPHOCYTES; MICROANALYSIS; OCCUPATIONAL EXPOSURE

27270 (INIS-mf–11406, pp. 51) **On heavy ion track structure and possible biological implications.** Temkin, A.Ya. (Tel Aviv Univ. (Israel). Dept. of Interdisciplinary Studies). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL HOT SPOTS/heavy ions; HEAVY IONS/biological hot spots; CELL KILLING; CHEMICAL RADIATION EFFECTS; DNA; GENETIC RADIATION EFFECTS

27271 (INIS-mf–11406, pp. 52) **Relative biological effectiveness of 24 KeV neutrons: cell survival and micronucleus induction in mammalian cells.** Mill, J.A. (CEGB Berkley Nuclear Laboratories, (UK) Radiobiology Lab.); Hall, S.C.; Wells, J.; Newman, S.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/survival curves; INTERMEDIATE NEUTRONS/rbe; COMPARATIVE EVALUATIONS; RBE; KEV RANGE 10-100; MAMMALS; NEUTRON BEAMS

27272 (INIS-mf–11406, pp. 53) **Increasing complexity of chromosomal rearrangements after heavy ion bombardment of increasing LET's.** Sabatier, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)); Al Achkar, W.; Dutrillaux, B. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHROMOSOMAL ABERRATIONS/heavy ions; EXTERNAL IRRADIATION/heavy ions; ANIMAL CELLS; BANDING TECHNIQUES; MAMMALS; MEV RANGE 100-1000; RADIATION QUALITY

27273 (INIS-mf–11406, pp. 54) **Cellsurvival and chromosomal aberration frequency in V79 cells exposed to low energy protons.** Pialoglou, P. (2110000GR); Sideris, E.G.; Perris, A. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

EXTERNAL IRRADIATION/protons; FIBROBLASTS/chromosomal aberrations; CELL PROLIFERATION; DOSE-RESPONSE RELATIONSHIPS; PROTONS; FIBROBLASTS; GENETIC RADIATION EFFECTS; RBE; SURVIVAL CURVES

27274 (INIS-mf–11406, pp. 56) **Historical review of concepts of the mechanisms of late radiation effects in the central nervous system.** Calvo, W. (Ulm Univ. (Germany, F.R.). Inst. of Occupational and Social Medicine). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CENTRAL NERVOUS SYSTEM/delayed radiation effects; REVIEWS

27275 (INIS-mf–11406, pp. 57) **Ultrastructural and cell kinetic changes in glial cells.** Reyners, H. (Centre d'Etude de

l'Energie Nuclaire CEN/SCK Mol (Belgium). Dept. of Radioprotection after irradiation). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CEREBRAL CORTEX/delayed radiation effects; DELAYED RADIATION EFFECTS/ultrastructural changes; BIOCHEMICAL REACTION KINETICS

27276 (INIS-mf–11406, pp. 58) **Role of vascular lesions in the development of late CNS damage.** Hopewell, J.W. (Oxford Univ. (UK)); Yeung, T.K.; Calvo, W.; Reinhold, H.S. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BLOOD VESSELS/radiation injuries; BRAIN/necrosis; BRAIN; NECROSIS; DELAYED RADIATION EFFECTS; DOSE-RESPONSE RELATIONSHIPS; MORPHOLOGICAL CHANGES; RATS; TIME DEPENDENCE

27277 (INIS-mf–11406, pp. 63) **Combined effects of irradiation and chemicals on CNS development.** Michel, C. (Zurich Univ. (Switzerland). Strahlenbiologisches Inst.). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CENTRAL NERVOUS SYSTEM/prenatal irradiation; RESPONSE MODIFYING FACTORS/prenatal irradiation; DRUGS; EMBRYONIC CELLS; HEALTH HAZARDS; LET

27278 (INIS-mf–11406, pp. 65) **Dose rate dependence of mutation induction in mammalian cells and yeast.** Kiefer, J. (Giessen Univ. (Germany, F.R.). Strahlenzentrum); Keonig, F.; Crompton, N.; Mueller, J.; Stoll, U. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MUTATIONS/dose-response relationships; ANIMAL CELLS; CELL CULTURES; COMPARATIVE EVALUATIONS; GAMMA RADIATION; HAMSTERS; MUTATION FREQUENCY; MUTATIONS; YEASTS

27279 (INIS-mf–11406, pp. 67) **Dna recombinant methodologies and oligonucleotides in radiation biology.** Teoule, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Duplaa, A.M.; Guy, A.; Harel, P.; Molko, D.; Schulhof, J.C. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL RADIATION EFFECTS/nucleotides; BIOLOGICAL RADIATION EFFECTS/recombinant dna; NUCLEOTIDES; COMPUTERIZED SIMULATION; GAMMA RADIATION; RADIOBIOLOGY; RADIOSENSITIVITY

27280 (INIS-mf–11406, pp. 68) **Radiation response of the thyroid. Survival and alterations towards malignancy in cell culture and human systems.** Malone, J.F. (Saint James's Hospital (UK)); Mothersill, C.; Tuohy, B.; Seymour, C.; Lewis, M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL CULTURES/survival curves; THYROID/dose-response relationships; ACUTE EXPOSURE; ANIMAL CELLS; GAMMA RADIATION; SHEEP; THYROID; X RADIATION

27281 (INIS-mf–11406, pp. 69) **Binding position of certain metal ions on the dna and its relationship to radiation induced genetic lesions in V-79 cells in culture.** Sideris, E.G. (Democritos Nuclear Research Center, Athens (Greece). Inst. of Biology). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL CULTURES/genetic radiation effects; GENETIC RADIATION EFFECTS/chemical bonds; CALCIUM IONS; COMPARATIVE EVALUATIONS; COPPER IONS; DNA ADDUCTS; HAMSTERS; IN VITRO; MAGNESIUM IONS; ZINC IONS

27282 (INIS-mf–11406, pp. 70) **Enahancement of cellular damage induced by gamma rays after inhibition of poly-(ADP-ribose)-polymerase by 3-aminobenzamide.** Pialoglou, P. (2110000GR); Sideris, E.G.; Perris, A. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL KILLING/cell cultures; CHROMOSOMAL ABERRATIONS/cell cultures; POLYMERASES/inhibition; ANIMAL CELLS; GAMMA RADIATION; POLYMERASES; INHIBITION; SURVIVAL CURVES

27283 (INIS-mf–11406, pp. 71) **Sequence specifity of (^{125}I)-labelled Hoechst 33258 in intact human cells.** Murray, V. (Cancer Inst., Melbourne (Australia)); Martin, R.F. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/dna sequencing; IODINE 125; LABELLED COMPOUNDS; STRAND BREAKS

27284 (INIS-mf–11406, pp. 74) **Nucleoid sedimentation: Dna radiation damage, repair and retrospective dosimetry.** Louw, W.K.A. (Pretoria Univ. (South Africa)); Rensburg, E.J. van; Izatt, H.; Engelbrecht, R.I. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL INDICATORS/dosimetry; DNA REPAIR/biological indicators; DOSIMETRY; IN VIVO; LYMPHOCYTES; RADIATION INJURIES; SEDIMENTATION

27285 (INIS-mf–11406, pp. 76) **On the possible role of nucleoproteins in repair of radiation induced DNA damage.** Schneeweiss, F.H.A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin); Feinendegen, L.E.; Sharan, R.N. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DNA REPAIR/nucleoproteins; NUCLEOPROTEINS; IN VIVO; STRAND BREAKS

27286 (INIS-mf–11406, pp. 80) **Calculation method of PLD recovery based on saturation kinetics.** Baumstark-Khan, C. (Bonn Univ. (Germany, F.R.). Inst. fuer Strahlenbiologie). European

Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL RECOVERY/biochemical reaction kinetics; LETHAL RADIATION DOSE/correlations; BACTERIA; FIBROBLASTS; CORRELATIONS; RADIATION INJURIES; REGRESSION ANALYSIS; SATURATION; STOCHASTIC PROCESSES; TIME DEPENDENCE; YEASTS

27287 (INIS-mf–11406, pp. 86) **Characteristics of three types of lethal lesions in yeast.** Holt, P.D. (UKAEA Atomic Energy Research Establishment, Harwell (UK)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LETHAL IRRADIATION/comparative evaluations; YEASTS/lethal irradiation; ANIMAL CELLS; DNA REPAIR; MAMMALS; STRAND BREAKS; SURVIVAL CURVES; YEASTS

27288 (INIS-mf–11406, pp. 2) **Effects of fractionated doses of x-rays on pig lung.** Rezvani, M. (Churchill Hospital, Oxford (UK)); Hopewell, J.W. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LUNG CLEARANCE/delayed radiation effects; LUNGS/fractionated irradiation; DOSE-RESPONSE RELATIONSHIPS; EARLY RADIATION EFFECTS; LUNGS; SWINE; X RADIATION

27289 (INIS-mf–11406, pp. 82) **Cell stage specifity of ultraviolet light and sodium arsenite on the induction of chromosome aberrations.** Huang, H. (Tsing-hua National Univ., Hsinchu (China). Inst. of Radiation Biology); Peng, C.L. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CELL CYCLE/ultraviolet radiation; CHROMOSOMAL ABERRATIONS/cell cycle; HAMSTERS; INDUCTION; OVARIES; STRAND BREAKS

27290 (INIS-mf–11406, pp. 103) **Ability of ethanolic extract of propolis (EEP) to protect mice against gamma irradiation and its radical scavenging mechanism in vitro.** Scheller, S. (Silesian School of Medicine, Zabrze-Rokitnica (Poland). Dept. of Microbiology); Krol, W.; Gazda, G.; Czuba, Z.; Gabrys, J.; Zajusz, A.; Wilczok, T.; Imielski, S.; Shani, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIATION PROTECTION/mice; RADIOPROTECTIVE SUBSTANCES/scavenging; GAMMA RADIATION; MICE; SCAVENGING

27291 (INIS-mf–11406, pp. 101) **Clastogenic factors, a consequence of oxyradical generation.** Emerit, I. (Paris-6 Univ., 75 (France)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHROMOSOME BREAKAGE/biochemistry; BLOOD PLASMA; CARCINOGENESIS; CELL TRANSFORMATIONS; BIOCHEMISTRY; IN VITRO; SUPEROXIDE DISMUTASE

27292 (INIS-SU–81/A) **Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.** Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. 91p. (In Russian). Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

A collection of papers dealing with practical aspects of radiation protection in medical uses of radiation.

27293 (INIS-SU–81/A, pp. 39-48) **Injuries of reticuloendothelial system in case of local external and internal irradiation of liver and preventive measures.** Merkushev, G.N. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

A degree of intracellurlar structure injuries of liver reticuloendothelial system (RES) in case of its local external and internal irradiation and a possibility of injury modification with chemical radioprotectors were studied by light and electron emission. Significant morphofunctional changes in kupffer cells were noted. Internal irradiation with Ce^{144} with concentration of 7.4 MBq sharphy decreases kupffer cell phagocytosis at certain periods. Use of mea and other lipophilic compounds considerably decreases the degree of mitochondria and liposome injuries in kupffer cells. The efficiency of liver protection in case of incorporated irradiation can be attained only by creation of complex compounds including radioprotective substances, sorbents enabling to excrete colloid particle of radioisotopes from the liver alongside with radioprotective effect. 8 refs.

27294 (INIS-SU–81/A, pp. 48-57) **Peculiarities of intestine injuries in case of internal and external irradiation: a morphometric study.** Ponomareva, T.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

It is shown that sterological cell parameters and indexes of their interaction may serve as an important characteristic of tissue postirradiation recovery quality permitting to give a precise quantitative characteristic of cell differentiation and dedifferentiation. It is established that enterocyte maturation is sharphy broken under irradiation. Population delamination into sublines differing in cell size takes place. The number of these cells depends on radiation doses. The most labile cell componenet is cell nucleoli. The cell differentiation breakage is more pronounced in case of internal irradiation (Ce^{144}) and in combined radiation effect. A degree of cell differentiation breakage depends on peroxidation level. The obtained data can be used in developing and evaluating radioprotective substances. 11 refs.; 2 tabs.

27295 (INIS-SU–81/A, pp. 58-64) **Prospects in biochemical methods application in testing local injuries and its modification.** Artamonova, E.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

A set of biochemical tests, characterizing the state of healthy organs of persons subjected to irradiation is created to develop models for preventing delayed radiation effects. Lipid peroxidation serves as a basic theory of radiation injury reaction. Functional and biochemical peculiarities of the organs are also considered. Diagnostic tests for salivary glands and liver are proposed. It is ascertained that determination methods of lipid peroxidation acid phosphatase activity can serve as indicators of liver radiation injury. Lipid peroxidation significantly increases in case of local irradiation of salivary glands and liver it is advisable to use synthetic antioxidants to decrease lipid peroxidation products in order to prevent biochemical changes in parenchymous organs and to promote organism detoxication. 8 refs.; 3 tabs.

27296 (JINR–19-88-144) **Calculation algorithm of microdosimetric f(Z,D) function.** Chernenko, L.P.; Kozubek, S. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1988. 11p. (In Russian). Order Number DE88706308/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The calculation algorithm of the dose-dependent distribution f(Z,D) in the microvolumes typical of pro- and eucaryotic cells is described. The energy distribution in the track of charged particle including δ-electrons is considered. The subroutines written in Fortran and tested on CDC-6500 computer are shown. 4 refs.; 3 figs.

27297 (PB–89-162085/XAB) **Effects of acute radiation on reproductive success of the polychaete worm Neanthes arenaceodentata. Final report.** Harrison, F.L.; Anderson, S.L. Lawrence Livermore National Lab., CA (USA). Environmental Sciences Div. Dec 1988. 58p. Available from NTIS, PC A04.

Laboratory populations of the polychaete worm Neanthes arenaceodentata were exposed to acute doses of external gamma radiation to determine effects on reproduction. Groups of mated pairs received either no radiation (controls) or 0.5, 1.0, 2.0, 5.0 10 or 50 Gy. The doses were delivered at the time when oocytes were visible in the females and at a rate of 5 Gy/min. The broods from the mated pairs were sacrificed before hatching occurred, and information was obtained on brood size, on the number of normal and abnormal embryos, and the number of embryos that were living, dying, and dead. An important effect of acute irradiation was increased mortality of the embryos. Except for those mated pairs that received 10 or 50 Gy, there was no evidence for gamete loss or for reduced fertilization success; the number of embryos in the brood did not decrease with increased dosage. The results on embryo abnormality and mortality indicate that lethal mutations were most likely induced in the germ cells and that these affected survival of the early life stages.

27298 (SSA–1988-TS-9) **Scientific works 1987. Centre de Recherches du Service de Sante des Armees.** Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. 321p. Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Items within the scope have been entered individually in the data base.

27299 (SSA–1988-TS-9, pp. 37-38) **Radioprotective effects of selenium and WR 2721: synergy and possible involvement of prostanoids.** Bienvenu, P. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Herodin, F.; Fatome, M.; Kergonou, J.F. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Testing chemical radioprotective efficiency of selenium and WR 2721 on CD 1 male mice, it was shown that acetylsalicylic acid, given "per os", may either strengthen the radioprotective efficiency of these two substances, for low or intermediate radiation doses, or counteract their protective effects, in the case of high radiation doses. Tentative explanations are presented on the basis of oxygen metabolism and its modulation by metal or metalloid activators.

27300 (SSA–1988-TS-9, pp. 33-34) **Quantitative analysis of in vitro irradiated resting lymphocytes with radioprotector WR 2721. Quantitative analysis of T lymphocytes subpopulations.** Hainaut, J. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Nicolas, R.; Delemer, R.; Fatome, M.; Brugal, G.; Camus, E.; Helene, D. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

100 cells are sufficient to obtain significant results. WR 2721, like gamma rays, increases access to labeling targets of PrI and BrdUrd in unirradiated lymphocytes; WR 2721 decreases access in in vitro 5.7 Gy irradiated lymphocytes until 128 ng per cell. At higher concentration, WR 2721 effects are the same as gamma rays effects. BrdUrd and PrI labeling increases from 30 to 120 mn of preincubation with WR 2721, and decreases after 120 mn until 180 mn. The labeling increases after radiation is higher in T 8 than in T 4 lymphocyte subpopulation.

27301 (SSA–1988-TS-9, pp. 29-30) **Relationship between structure and "decorporative" efficiency in the diphosphonate chemical series.** Gerasimo, P. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Daumas, M.; Mathieu, J.; Burgada, R.; Metivier, H. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Molecular structure of some diphosphonates was studied by topological analysis. The investigated activity was the efficiency of the molecules to remove injected plutonium from the organism, in order to correlate some topological properties of these molecules to their decorporating ability. The studied polyphosphonates have been divided into two families: unprotected and protected compounds. Only unprotected compounds clearly show structure activity relationships. Though structurally different from the rest of the family, LICAM (C) well fits the correlation. An interpretation was that a better efficiency might be related to the branching of the molecules.

27302 (SSA–1988-TS-9, pp. 35-36) **Protective action afforded by the radioprotector WR 2721 against the toxicity of caryolysine.** Fatome, M. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Laval, J.D.; Sentenac-Roumanou, H. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

If WR 2721 is injected by intraperitoneal way to mice at 300 $mg.kg^{-1}$ 15 minutes before caryolysine, it lowers its toxicity with a factor equal to 1.9. At the opposite, it has no effect if it is injected 5 minutes after it. This effect can be explained by the fixation of caryolysine on WR 2721 or on its thiol and by interaction of WR 2721 or, at least, its thiol with DNA.

27303 (SSA–1988-TS-9, pp. 27-28) **Notions used in chelation chemistry and in change of valences, applied to the treatment of contaminations by neptunium.** Gerasimo, P. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Mathieu, J.; Metivier, H. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Difficulties in treatment of neptunium contamination result from the fact that in blood neptunium exists at the V valence. Its reduction to the IV valence was obtained by vitamin C. Under these conditions DTPA was efficient to obtain decorporation, but its effect was not greater than the one obtained by a perfusion of isotonic saline solution.

27304 (SSA–1988-TS-9, pp. 25-26) **Burn injury influence on vital pronostic after total body irradiation preliminary results.** Doucet, J. (Etablissement Technique Central de l'Armement (ETCA), 94 - Arcueil (France)); Destombe, C.; Mass, J. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

One hour after total body gamma rays or mixed neutron-gamma irradiation (3.6 Gy), pigs are burned at the second degree on twenty percent of corporal surface. First results show that the vital prognosis is not increased by burn injury; the lethality ratio decreases.

27305 (SSA–1988-TS-9, pp. 23-24) **Protective effect of a non specific inflammation on bone marrow protein synthesis in irradiated mice.** Herodin, F. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Roques, P.; Court, L. Centre de Recherches du Service de Sante des Armees,

92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Gamma radiations exert a decrease in mouse bone marrow total protein synthesis. A non-specific inflammatory process induced with polyacrylamide microbeads stimulates spleen and marrow protein synthesis and protects the medullar protein synthesis in irradiated mice.

27306 (SSA–1988-TS-9, pp. 21-22) **Effects of gamma-irradiation on rat myocardial DHP binding sites.** Agasse, J. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Martin, C.; Court, L. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

Sensitive voltage-dependent calcium channel from cardiac tissue was studied two and six hours after gamma-irradiation of 10, 25, 50 and 75 Gry. DHP low affinity receptor is altered at 75 Gy and these alterations are similar to these observed on hypoxic heart.

27307 (SSA–1988-TS-9, pp. 19-20) **Vasoactive intestinal peptide-stimulated cyclic AMP production in rat intestinal epithelium after gamma irradiation.** Chastre, E. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Martin, C.; Court, L. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

VIP-receptors activity was studied in rat intestinal epithelium one to seven days after gamma irradiation (6 to 10 Gy). VIP-stimulated cAMP production was compared to forskoline-stimulated cAMP production. This production is decreased after irradiation; this modification is probably due to intestinal epithelium necrosis.

27308 (SSA–1988-TS-9, pp. 17-18) **Effect of cephalic and whole-body gamma irradiation on the evolution of spongiform encephalopathies.** Court, L. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Gourmelon, P.; Dormont, D.; Bassant, M.H.; Cathala, F. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

The cephalic and whole body gamma irradiation does not influence the incubation period and the duration of disease of experimental slow virus spongiform encephalopathies (scrapie of mouse, 0.5, 2 Gy, kuru and Creutzfeldt Jakob disease of primates 0.75 and 1.5 Gy). The delay of first EEG alterations does not change but generally for all experimental diseases the intensity and the repartition of neuro histological lesions (gliosis and spongiosis) increase.

27309 (SSA–1988-TS-9, pp. 15-16) **Radiosensitivity of the brain during the postnatal development: the olfactory bulb, the dentate gyrus, the cerebellum.** Gueneau, G. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Ghnassia, J.P.; Baille-Le-Crom, V.; Court, L. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

In the olfactory bulb of the young rabbits irradiation induces pycnotic cells in the subependymal layer with some ones scattered in the granular layer. The cytological and autoradiographic study allows to say that the radiosensitive cells are precursors of granular and glial cells. The proliferative source is the subependymal layer of the lateral ventricle. The characteristics of three proliferative layers: the subgranular zone of the dentate gyrus, the external granular layer of the cerebellum and the subependymal layer of the olfactory bulb, are compared.

27310 (SSA–1988-TS-9, pp. 13-14) **Radiation induced effects on the striatal dopaminergic activity.** Chastre, E. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Martin, C.; Court, L. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

D 1 and D 2 receptor densities and activities were studied in the brains of control and irradiated rats with 1 MeV fission neutrons (gamma/N = 0.2). Irradiation of 4-8 Gy induces an increase of D 1-receptor density in the striatum while the D 2-receptor density and affinity were unchanged.

27311 (SSA–1988-TS-9, pp. 11-12) **Gabaergic system changes after gamma and neutron/gamma whole body irradiation.** Velly, M.R. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Court, L.; Fatome, M.; Martin, C.; Gerasimo, C. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

With binding methods, we establish that neutron/gamma irradiation doesn't alter the benzodiazepines'receptors in the rat but strongly decreases the affinity of GABA high-affinity binding sites in the cortex and of GABA low-affinity binding sites in the cerebellum; the threshold is probably 7 Gy. The results agree with the hypothesis that all GABA binding sites are not an integral part of the "GABA-benzodiazepine receptors" complex.

27312 (SSA–1988-TS-9, pp. 9-10) **Lesions induced by a N-gamma global irradiation in baboons.** Mestries, J.C. (Centre de Recherches du Service de Sante des Armees, 38 - La Tronche-Grenoble (FR)); Picard, G.; Court, L.; Fatome, M.; Doucet, J.; Neveux, Y. Centre de Recherches du Service de Sante des Armees, 92 - Clamart (France). 1988. (In French). In *Scientific works 1987. Centre de Recherches du Service de Sante des Armees.* Order Number DE89764017/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

In baboons exposed to a N-gamma irradiation (N/gamma = 5.5) at a dose of 5 Gy, the clinical picture is characterized by digestive haemorrhagic lesions which can lead to the death during the two first weeks. These lesions are related to an important increase of the activated partial thromboplastin time (APTT) which seems to be a quite better prognostic element than the platelets drop. In surviving animals, it appears a severe cutaneous fibrosis of the front face.

27313 Determining the ratio of ^{239}Pu to ^{241}Am in wounds by measuring the L gamma x-rays with a Si(Li) detector. Palmer, H.E. (Pacific Northwest Laboratory, Richland, WA (USA)); Rhoads, M.C. *Health Physics (USA),* 56(2): 249-252 (Feb 1989).

A Si(Li) planar detector provides sufficient photopeak resolution to resolve the 20.16-keV U L gamma x rays resulting from ^{239}Pu decay and the 20.78-keV Np L gamma x rays resulting from ^{241}Am decay. The energies and, therefore, the absorption coefficients of the two x rays are very similar; thus, the ratio of the peaks for a source embedded in tissue remains approximately the same for the two x rays up to at least 6 mm. Measurements of ^{239}Pu-to-^{241}Am ratios by this method in deep wounds agree with results obtained by radiochemical analysis of excised tissue.

27314 Quantitative scanning electron microscopic autoradiography of inhaled $^{239}PuO_2$. Sanders, C.L. (Pacific Northwest Laboratory, Richland, WA (USA)); Lauhala, K.E.; McDonald, K.E. *Health Physics (USA),* 56(3): 321-325 (Mar 1989).

We have applied the scanning electron microscope (SEM) to obtain autoradiographs of particles of $^{239}PuO_2$ deposited in rat lung. The technique was used to obtain quantitative information on the clearance rates of particles from the alveoli, bronchioles and trachea up to 240 d after exposure. At all times, the concentration of particles on the surface of the bronchioles was an order of magnitude greater than on the tracheal surface. The clearance of Pu from both regions followed a biphasic pattern, similar to that obtained by radiometric analysis of the whole lung. Most of the radiation dose to

the bronchiolar epithelium originated from Pu particles in peribronchiolar alveoli in which they were preferentially retained, compared to other alveolar regions. The prolonged retention of particles in the peribronchiolar alveoli may be a significant factor in the induction of lung carcinomas.

5602 Thermal Effects

Refer also to citation(s) 27683

27315 (DOE/ER/13214–3) **[Effects of freezing and cold acclimation on the plasma membrane of isolated protoplasts]: Progress report, 16 May 1988–9 January 1989.** Cornell Univ., Ithaca, NY (USA). 1989. 7p. DOE Contract FG02-84ER13214. Order Number DE89010931/JAW. Available from NTIS, PC A02 - OSTI.

The emphasis of this project is on the form of injury referred to as loss of osmotic responsiveness (LOR). Our goals are to provide a mechanistic understanding of freeze/dehydration-induced mesomorphic phase transitions in the plasma membrane that are manifested as alterations in the ultrastructure (lateral phase separations, a particulate lamellae, and hexagonal configurations) and which result in the loss of osmotic reponsiveness of NA protoplasts and to determine the cellular and molecular mechanisms by which cold acclimation and cryoprotectants preclude or diminish these alterations in the plasma membrane of ACC protoplasts. As a working hypothesis, we propose that the alterations in the ultrastructure of the plasma membrane of NA protoplasts that are responsible for LOR are a consequence of lipid demixing that occurs as a result of the close approach of bilayers during freeze-induced dehydration. Normally the close approach of two bilayers is precluded because of the large repulsive forces (hydration forces) resulting from the strong affinity of the hydrophilic surfaces for water. However, large osmotic potentials occur during the freezing of aqueous solutions and are of sufficient magnitude to overcome the hydration forces. Theory predicts that large lateral pressures will occur during the resultant close approach of the bilayers and will result in phase separation of the bilayer components. The fact that lateral phase separations and hexagonal phases are not observed in ACC protoplasts subjected to freeze-induced dehydration indicates that cold acclimation decreases the propensity to undergo demixing and lateral segregation of the membrane components. Our working hypothesis is that this is, in part, a consequence of alterations in the lipid composition of the plasma membrane and possibly the increased cytoplasmic concentrations of solutes such as sucrose and proline. 11 refs.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 26276, 27064, 27081, 27179

27316 (AD-A–202722/5/XAB) **Evaluation of 90-day inhalation toxicity of petroleum and oil-shale diesel fuel marine (DFM). Final technical report, November 1977-January 1985.** Gaworski, C.L.; MacEwen, J.D.; Vernot, E.H.; Haun, C.C.; Leahy, H.F. California Univ., Dayton, OH (USA). Dec 1985. 38p. Available from NTIS, PC A03/MF A01.

Subchronic 90-day inhalation toxicity studies were conducted to compare the toxicity of petroleum and oil-shale-derived diesel fuel marine (DFM). Beagle dogs, Fischer 344 rats, and C57BL/6 mice were continuously exposed to DFM at concentrations of 50 mg/cu. m and 300 mg/cu. m. Unexposed controls were also maintained. All dogs and a portion of each rodent group were sacrificed and examined at exposure termination. The remaining rodents were held for observation up to 21 months postexposure. Male rats exposed to DFM for 90 days developed nephrotoxic changes characterized by hyaline degeneration, necrosis, and intratubular cysts. Subsequently, male rats exposed to 300 mg/cu. m DFM developed mineralization and papillary hyperplasia. These postexposure renal changes were generally less severe in male rats exposed to 50 mg/cu. m Shale DFM and were absent in male rats exposed to 50 mg/cu. m Petroleum DFM. Female rats as well as dogs and mice exposed to DFM were free of significant renal damage. Mild reductions in body-weight gains and erythrocyte parameters were also noted in male rats exposed to DFM. Neither material produced significant tumor formation in any species tested. The results of this study are consistent with the effects noted in other hydrocarbon-fuel toxicity studies. Comparison of the effects observed in these studies with petroleum or shale suggest only minor differences between the two materials.

27317 (CONF-890466–1) **Environmental risk assessment/environmental hazard assessment: Similarities and differences.** Suter, G.W. II. Oak Ridge National Lab., TN (USA). 1989. 28p. DOE Contract AC05-84OR21400. From 13. symposium on aquatic toxicology and risk assessment; Atlanta, GA, US; April 16, 1989. Order Number DE89010178/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Risk assessment and hazard assessment are alternate paradigms for assessing the effects of chemicals and other hazards on the environment. Risk assessment is an old assessment tradition that grew out of actuarial statistics and is concerned with estimating the probability of undesired events. Hazard assessment was developed in the late 1970s as a means of performing assessments by iteratively (1) testing and measuring the properties of chemicals, (2) comparing toxicity test endpoints to estimated environmental concentrations, and then (3) deciding whether the chemical is clearly safe, clearly hazardous, or requires more testing. These two paradigms have much in common in that they attempt to apply environmental toxicology, environmental chemistry, and scientifically-based logic to the regulation chemicals. In this respect, they differ from the regulation of hazards by absolute prohibitions, political negotiations, adversarial proceedings, and technology-based standards. 26 refs., 3 figs., 1 tab.

27318 (NP–9764710) **Heavy metal concentrations in the blood, urine and hair of persons employed in public institutions (research) and occasionally exposed to heavy metals. A retrospective study 1975 to 1984.** Conze, J. Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet. 9 Apr 1987. 145p. (In German). Order Number DE89764710/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The thesis looks into the following questions: 1. What heavy metal concentrations were found in the biological material of staff of the Rheinisch-Westfaelische Technische Hochschule Aachen who were assumed to have been exposed to heavy metals? 2. Is there evidence of increased concentrations of heavy metals in certain professions, institutes, or persons employed in individual workplaces as compared to others? 3. What are the specific characteristics of workplaces believed to carry a risk? 4. Do these workplaces differ from corresponding industrial jobs, and in how far? 5. Are further steps and changes appropriate beyond the currently practised, organizational and technical, measures to protect staff against materials containing heavy metals, and if so, what would these be? For the greater part of the persons investigated, the values found in the period of observation for lead, mercury, cadmium, arsenic and chromium were in the normal. range. If values higher than the normal range were established, they were, as a rule, only moderately higher. Individual persons were, however, found to excrete temporarily substantially increased amounts of arsenic as compared to normal.

27319 (PB–89-145346/XAB) **IARC (International Agency for Research on Cancer) 1987 re-evaluation of carcinogenicity of mineral oils and bitumens: CONCAWE comments and interpretation.** Butler, M.S.; Heitzman, P.F.; Simpson, B.J.; Smith, J.D.; Yardley-Jones, A. Concawe, The Hague (Netherlands). 1988. 20p. (CONCAWE–7/88). Available from NTIS, PC EE02/MF A01.

Following the IARC 1987 re-evaluation of carcinogenicity of mineral oils and bitumens, CONCAWE decided to ensure that all who may be concerned with the carcinogenicity classifications of these petroleum products, including national and international regulatory authorities, are aware of the reasons for the differences between the 1984 and 1987 IARC classifications and of CONCAWE's reservations concerning the revised classifications. The document reviews important differences between the new and previous evaluations, which are summarized in tabular form, and also indicates how the differences have occurred and provides CONCAWE's interpretation of the available evidence, taking into account points discussed with IARC.

27320 (PB–89-145502/XAB) **Cytogenetic study of workers exposed to ethylene oxide: analysis of the sister chromatid exchange assay data with a discussion of occupational-exposure**

data. Meinhardt, T.; Carrano, A.; Moore, D.; Ashworth, L.; Marlow, D. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Dec 1985. 76p. Available from NTIS, PC A05/MF A01.

See also PB–86-221579 and PB–89-145510.

A survey of the cytogenetic effects of exposure to ethylene oxide was conducted on 43 workers in ethylene oxide production units and 27 workers in a quality-assurance laboratory who were exposed to ethylene oxide and other chemicals. Circulating lymphocytes were isolated and assayed for chromosomal aberrations. Median ethylene oxide exposures ranged from 0.14 to 10.9 parts per million (ppm) in the laboratory and 0.19 to 1.0 ppm in the production unit. No significant increase in the incidence of chromosomal aberrations occurred in the production unit workers. Increases in the incidence of chromatid deletions and exchanges, total chromatid aberrations, percent of abnormal cells, and total aberrations per cell occurred in the laboratory workers. Working in ethylene oxide production units may not cause a statistically significant increase in chromosomal aberrations. Work in the quality-assurance laboratory is associated with genotoxic effects; however, these cannot be attributed solely to ethylene oxide due to the complex nature of the working environments.

27321 (PB–89-145510/XAB) **Cytogenetic study of workers exposed to ethylene oxide: analysis of the chromosomal-aberration data and overall conclusions from the analyses of sister chromatid exchanges and chromosomal aberrations.** Meinhardt, T.; Carrano, A.; Moore, D.; Ashworth, L.; Marlow, D. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Dec 1985. 64p. Available from NTIS, PC A04/MF A01.

See also PB–89-145502.

A survey of sister chromatid exchange (SCE) incidence among workers occupationally exposed to ethylene oxide was conducted. The effects of smoking were also investigated. The cohort consisted of 44 workers in ethylene oxide production units and 27 workers in a quality assurance laboratory having exposure to ethylene oxide and other chemicals. Circulating lymphocytes were obtained from the subjects and assayed for SCEs. Personal ethylene oxide exposures were measured. Median exposures to ethylene-oxide were 0.19 to 1.0 part per million (ppm) in the production workers and 0.14 to 10.9 ppm in the laboratory workers. Cigarette smoking comparisons had a higher statistically significant incidence of SCEs than nonsmokers. Nonsmoking production workers had a marginally statistically significant elevation of SCEs compared to smoking comparisons. Cigarette smoking production workers had an insignificant excess incidence of SCEs. SCE incidence was statistically significantly increased in smoking and nonsmoking laboratory workers. The data suggests an additive relationship between the effect of cigarette smoking and employment in ethylene oxide production units. The effects of smoking and employment in the laboratory are less than additive.

27322 (PB–89-145528/XAB) **Health-hazard evaluation determination report no. HHE-76-063-487, BASF Wyandotte Corporation, South Kearny, New Jersey.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1978. 9p. (HHE–76-063-487). Available from NTIS, PC A02/MF A01.

A health-hazard evaluation of the BASF Wyandotte Corporation, South Kearney, New Jersey, was performed to investigate hazardous exposures to vinylidene chloride by screening workers for evidence of liver malfunction. All workers were invited to participate in the evaluation. Testing consisted of a questionnaire regarding occupational/medical history, and blood analyses of total bilirubin, serum glutamic oxalic transaminase, serum glutamic pyruvic transaminase, alkaline phosphatase, and gamma glutamyl transpeptidase. Of 300 workers currently employed, 256 participated. Of those participating 75 had at least one blood test result that was above the upper limit of the control values. Workers in the Pa-Dop plant had the largest number of liver abnormalities than any other area of the plant. Agents responsible for this difference have not been identified. It was recommended that the Pa-Dop plant be monitored through medical screening and industrial hygiene to more completely classify its environment.

27323 (PB–89-146344/XAB) **Health-hazard evaluation determination report No. 77-007-486, Union Electric Company, St. Louis, Missouri.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1978. 31p. (HHE–77-007-486). Available from NTIS, PC A03/MF A01.

To determine possible hazardous exposure to polychlorinated biphenyls (PCB), a health hazard evaluation of the Union Electric Company, St. Louis, Missouri, was conducted. Breathing-zone samples were collected from workers considered to have highest potential risk. Medical evaluations were performed using questionnaire information regarding occupational/medical histories and exogenous exposures (alcohol, tobacco, drugs). Blood and urine tests were performed. At the time of the survey, employees were exposed to levels of PCB in excess of the NIOSH recommended standard but below Federal standards for PCB during transformer overhaul operations. A final report of the medical evaluation is forthcoming. In addition, employees were not exposed to toxic levels of trichlorobenzene or 1,1,1-trichloroethane during operations involving transformer oils. Herbicide spraying operations at the time of the survey produced no toxic exposures to prophylene glycol butyl ether esters.

27324 (PB–89-148977/XAB) **Modulation of pulmonary defense mechanisms against viral and bacterial infections by acute exposures to nitrogen dioxide. Research report, October 1984-October 1987.** Jakab, G.J. Health Effects Inst., Cambridge, MA (USA). Nov 1988. 53p. (HEI/RR–88/20). Available from NTIS, PC A04/MF A01.

Levels of nitrogen dioxide (NO_2) exposure that induce increased susceptibility to viral and bacterial infections were studied in the murine animal mode. Physiological parameters of host resistance to respiratory infections were used as endpoints. The salient findings were: (1) intrapulmonary killing of staphylococcus aureus was impaired at 5.0 ppm of NO_2; (2) this effect was found at 2.5 ppm when NO_2 exposure was superimposed on immunosuppressed lungs treated with corticosteroids; (3) the adverse effect of NO_2 occurred at lower concentration when exposure followed bacterial challenge; and (4) during the course of murine Sendai virus infection, NO_2 exposure did not alter the infection in the lungs but did enhance lung pathology. The implications of these findings are that the antibacterial defenses of the lungs are susceptible to the inhibiting effects of acute exposures of lower concentrations of NO_2 when the lungs are predisposed by bacteria immunosuppression. The alveolar macrophage phagocytic system is the defense component most susceptible to the adverse effects of NO_2.

27325 (PB–89-151492/XAB) **Alternative ozone dose metrics to characterize ozone impact on crop yield loss (journal version).** Rawlings, J.O.; Lesser, V.M.; Heagle, A.S.; Heck, W.W. North Carolina State Univ., Raleigh, NC (USA). 1988. 9p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Environmental Quality, Vol. 17, No. 2, 285-291(1988).

Previous studies of the National Crop Loss Assessment Network (NCLAN) relating the impact of ozone (O_3) on agricultural crops have used the seasonal arithmetic average of O_3 for either a 7- or 12-h daily period as the measure of dose in the dose-response relationships. The study investigated the use of alternative dose metrics that gave differential weighting to hourly O_3 concentrations according to level of O_3, period of day, or total hourly solar radiation. Data were used from two NCLAN studies in which two different methods of O_3 addition were used for 7 h/d. In addition, one study included 12 h/d exposure for one method of O_3 addition. The residual sums of squares from fitting a common Weibull response model to each experiment were compared over the range of dose metrics. Weighting by total hourly solar radiation gave results very similar to the best obtained from differential peak-valley weighting and 7 h:5 h weighting.

27326 (PB–89-858161/XAB) **Air pollution effects on plants. September 1985-February 1989 (Citations from the NTIS data base). Report for September 1985-February 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 59p. Available from NTIS PC N01/MF N01.

Supersedes PB–87-853602.

This bibliography contains citations concerning the effects of combustion products, and industrial and automotive emissions on vegetation, forest stands, and agricultural crops. Some attention is given to the utilization of computer simulations as predictive tools,

and to the effects of acid precipitation and deposition. (This updated bibliography contains 87 citations, 16 of which are new entries to the previous edition.)

27327 (UCRL–21169-88) **Comparison of the response of mature branches and seedlings of Pinus ponderosa to atmospheric pollution: Annual report.** Houpis, J.L.J.; Surano, K.A.; Cowles, S.; Costella, M.P.; Benes, S.E.; Anderson, P.D. Lawrence Livermore National Lab., CA (USA). Mar 1989. 66p. DOE Contract W-7405-ENG-48. Order Number DE89010739/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Our first objective, the development and construction of a branch exposure chamber is near completion. We have conducted numerous tests on the BEC environment. Further characterization of the BEC internal environment will continue up until the time of field deployment. Continued BEC testing will enable us to improve the basic BEC design, and evaluate the effects of modifications made for delivery of acid precipitation. We have also made significant progress in the actual construction of the 90 BEC chambers that will be needed in the ozone and acid precipitation studies. To date, we have assembled BEC frames and fan housing components for all 90 BEC chambers to be used in the ozone and acid precipitation studies. Our second experimental objective, testing for branch autonomy, is in progress. We have completed the first of two pulse-studies, with final results of the first pulse-chase study expected in January 1989. The third major objective of our study is the actual exposure of the mature and seeding tissue. This aspect of our study is scheduled to begin in early 1989, and we expect to be on schedule. We are continually preparing for the establishment of our remote field site. Preparation has included the selection and finalization of our field site (USFS Tree Improvement Center, Chico, California). We have also serviced all analyzers that will be used at the field site and we have renovated the instrument trailers that will house all analytical equipment. We have also begun writing the necessary data acquisition and control program using a recently acquired Hewlett-Packard 9816 computer. 32 refs., 5 figs., 7 tabs.

27328 Mouse germ cell mutation tests in genetic risk evaluation of chemical mutagens. Generoso, W.M. (Oak Ridge National Lab., TN (USA)). *Cell Biology and Toxicology (USA)*, 4(4): 507-510 (Dec 1988).

That certain environmental chemicals can induce transmissible mutations in germ cells of experimental mammal is clear. The assumption that under certain conditions these chemicals are also likely to be mutagenic to human germ cells is not detectable. However, it is a difficult challenge to determine the level of human exposure at which such chemicals can be produced and used economically without significantly harming human health. Data on transmitted genetic effects in mice are necessary, not only as a measure of endpoints that are considered directly in genetic risk assessment, but also as the standard for evaluating the usefulness of non-germ-cell effects as predictors in genetic risk assessment. To carry out a real world genetic risk assessment exercise, in vivo mouse data are being obtained for two model chemicals–ethylene oxide and acrylamide. Both chemicals are capable of inducing transmissible genetic effects in mice; their production and use involve measurable human exposures; and, because they are socially and economically important, they are not likely to be banned altogether despite their mutagenicity. For both chemicals, data are not sufficient for accurate low-dose and low-dose-rate extrapolations.

5604 Other Environmental Pollutant Effects

27329 (DOE/CE/34014–T1) **[Low-intensity resonance interaction mechanisms in cells at 60Hz]: Final report.** Liboff, A.R. Oakland Univ., Rochester, MI (USA). Dept. of Physics. 20 Mar 1989. 76p. DOE Contract AC02-87CE34014. Order Number DE89010487/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

In this document, we generalize the many different observed ELF phenomena, referring to all of them in the singular: the ELF interaction. We develop the theme that this ELF interaction more often than not obeys simple ion cyclotron resonance (ICR) theory. This is true not only for the body of experimental work that is usually termed Ca-efflux studies, but also for practically all the many time-varying magnetic field experiments. Above all, the 60 Hz biological interactions fit precisely into this ICR framework.

27330 (PB–89-145304/XAB) **Ophthalmic instruments: an assessment of radiation emissions and potential hazards.** Ellingson, O.L.; Memmen, J.E.; Waxler, M. Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health. Dec 1988. 24p. (FDA/CDRH–89/18). Available from NTIS, PC A03/MF A01.

This report discusses the following: the optical radiation emitted by a variety of ophthalmic instruments were measured and compared to current safety standards. In addition, a survey of clinical diagnostic examination times was conducted to compare exposure safe times to visible lesion threshold. It was demonstrated that excessive levels of ultraviolet (UV) and infrared (IR) radiation could be emitted and should be eliminated. Several of the instruments emitted levels of visible radiation that resulted in very short safe times and could exceed the visible lesion threshold. Four experiments demonstrated instrument operating conditions that would reduce the potential for ocular hazards from ophthalmic instruments.

27331 (PB–89-859094/XAB) **Eye safety: irritants, exposure effects, and protective devices. January 1975-March 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-March 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 160p. Available from NTIS PC N01/MF N01.

Supersedes PB–87-861282.

This bibliography contains citations concerning the development, performance and applications of eye-protection devices. Eye protection from laser radiation is examined. Eye safe hand-held laser range finders, laser beam safety in tactical training, human eye exposure limitations to laser radiation, and the development and testing of protective goggles and glasses against laser beams are discussed. Fluorescent lighting effects on the human eye, eye strain from visual display units, and the use of closed circuit TV for monitoring hazardous engineering processes are considered. (This updated bibliography contains 260 citations, 40 of which are new entries to the previous edition.)

58 GEOSCIENCES

5801 Geology and Hydrology

Refer also to citation(s) 26384, 26823, 27146, 27162, 27339, 27340

27332 (AI–1988) **Water supply constraints to energy development - Phase 7. User's manual.** Acres International Ltd. (Canada). 1988. 390p. (MICROLOG–89-00643; CE–02563). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The federal government has recognized a need to develop a planning tool which will assist in the examination of water availability in different parts of the country vis a vis the current and future requirements for water. This need is particularly evident in Western Canada, where rapid growth of the energy sector coupled with growth in the agricultural sector, has caused, and will continue to cause, increasing stress on the water resource. Inland Waters Directorate Environment Canada initiated a multiphase study to develop such a planning tool. This is the 7th phase of this project. It includes further development of the graphic capabilities enhancements to the industrial water use and demand/price analysis routines, and a number of data processing improvements. Corresponding data base expansions were also carried out. The topics covered in this user's manual prepared by Acres Engineering are: concept of the water use analysis model, system description, model structure, and operating procedures. 11 refs., 19 figs., 10 tabs.

27333 (DOE/ER/13796–7) **Geologic spatial analysis program users guide for digital elevation model analysis procedures for**

detection of crustal fracture planes. Eliason, J.R.; Landle, G.L. Washington State Univ., Pullman, WA (USA). Dept. of Geology. 1 Jun 1988. 30p. DOE Contract FG06-87ER13796. Order Number DE89010880/JAW. Available from NTIS, PC A03 - OSTI.

The programs developed for analysis of digital elevation models to define crustal fracture planes have evolved from research initiated in 1983. This program users guide is a preliminary attempt to show users the sequence of programs used in the analysis. There are now 16 individual programs and as the research progresses, others will replace and/or complement those described here. The functions of the programs are briefly described in the sequence a user conducting an analysis would need to use them. Each program is then described and required interactive input is shown in bold text. The computer prompt "WASSU_RGA>" and all terminal statements and requests are provided as an example for the user. Input and output files are identified. Several of the programs require the user to run on a Digital Equipment Corporation VAX workstation GPX.

27334 (DOE/ER/13896–1) **Macrostatistical hydrodynamics: Progress report for year beginning April 15, 1988.** Brenner, H. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemical Engineering. 1988. 9p. DOE Contract FG02-88ER13896. Order Number DE89010482/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Our research efforts involve a collaboration with DEO-supported research groups at Sandia National Laboratories and Los Alamos National Laboratory. Work performed during this contract period involved making trajectory measurements of the three-dimensional position of the falling ball as a function of time for four differently-sized balls settling through a quiescent suspension. The suspensions consisted of monodisperse 0.635 cm diameter spheres that were neutrally buoyant and randomly distributed within a viscous Newtonian liquid at a solids volume fraction of f = 0.30. The experiments were conducted under carefully controlled conditions and involved 30-50 individual ball drops for each of the four falling-ball sizes studied. The ratio of the falling ball diameter to the suspended sphere diameter ranged from 0.5 to 4.0. Experimental observations were made with real-time radiography and recorded on split-screen, high-speed video.

5802 Geophysics

Refer also to citation(s) 26576, 27060, 27342

27335 (AD-A–203419/7/XAB) **Wave-form data collection for source-inversion studies. Annual report, 15 June 1987-14 June 1988.** Alexander, W.N.; Kimmel, R.H.; Malaspina, L. Ensco, Inc., Melbourne, FL (USA). 2 Aug 1988. 18p. (DCS-SYR–88-80). Available from NTIS, PC A03/MF A01.

The primary purpose of this contract on seismic-wave-form collection activities is to provide a data base of digital long-period seismograms from selected large underground explosions, to be used in source-inversion research. An added task requires the collection of digital Lg phases to be used in magnitude studies. Digital seismograms in this data base are collected by hand-digitizing analog seismograms from stations in the World Wide Standard Seismograph Network and by collecting existing digital data from stations in the Atomic Energy Detection System (AEDS). A number of waveforms have also been hand-digitized from AEDS analog recordings.

27336 (DOE/ER–0376) **The DOE Thermal Regimes Drilling Program through 1987.** USDOE Office of Energy Research, Washington, DC (USA). Office of Basic Energy Sciences. Jul 1988. 64p. (LBL–25486). Order Number DE89010074/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In response to strong endorsement from the scientific community, in the form of a report by the Continental Scientific Drilling Committee of the National Academy of Sciences (CSDC, 1984), the Office of Basic Energy Sciences of the DOE undertook a program of investigations of young magmatic intrusions and their associated thermal systems. To date, the effort has encompassed the first phases of a program to investigate the roots of active hydrothermal systems and has also investigated the thermal, chemical, and mechanical behavior of geologically recent (less than 600 years) magmatic extrusions. Shallow to intermediate-depth holes have been drilled and cored into hydrothermal systems in the silicic Valles and Long Valley calderas and at the crustal spreading center of the Salton Trough. These projects are briefly summarized here and are covered in greater detail in the accompanying appendices.

27337 **Methods for probabilistic assessments of geologic hazards.** Mann, C.J. (Univ. of Illinois, Urbana (USA)). *Journal of the International Association for Mathematical Geology (USA),* 20(5): 589-601 (Jul 1988). DOE Contract AC04-76DP00789.

Although risk analysis today is considered to include three separate aspects (1) identifying sources of risk, (2) estimating probabilities quantitatively, and (3) evaluating consequences of risk, here only estimation of probabilities for natural geologic events, processes, and phenomena is addressed. Ideally, evaluation of potential future hazards includes an objective determination of probabilities that have been derived from past occurrences of identical events or components contributing to complex processes or phenomena. In practice, however, data which would permit objective estimation of these probabilities of interest may not be adequate, or may not even exist. Another problem that arises normally, regardless of the extent of data, is that risk assessments involve estimating extreme values. Probabilities are required for events that are the greatest or rarest because they commonly will have the greatest consequences; the largest, or rarest, events always fall in tails of frequency distributions. Rarely are extreme values accurately predictable even when an empirical frequency distribution is established well by data. In the absence of objective methods for estimating probabilities of natural events or processes, subjective probabilities for the hazard must be established through Bayesian methods, expert opinion, or Delphi methods. Alternative solutions may involve consequence analysis which may demonstrate that, although an event may occur, its consequences are sufficiently small that it safely may be ignored or by establishing bounds which may demonstrate that although probabilities are not known they cannot exceed a maximum value that is sufficiently small so that associated risk may be considered to be negligible. Uncertainty of every probability determination must be stated for each component of an event, process, or phenomenon.

5803 Mineralogy, Petrology, and Rock Mechanics

Refer also to citation(s) 27340

27338 **Fabric transitions in plastically deformed limestones: the model.** Takeshita, T. (Los Alamos National Laboratory, NM (USA)). *Geological Society of America, Abstracts with Programs (USA),* 17: 732 (1985). (CONF-8510489–: 98. annual meeting of the Geological Society of America, Orlando, FL, US, October 28, 1985).

Fabric transitions are investigated based upon the Taylor-Bishop-Hill model. Fabric transitions are caused by the change in the activity of each slip system, which is totally the function of the critical resolved shear stress (CRSS) on it. These transitions are sometimes very drastic because the relative importance of each slip system for the accommodation of the same strain is suddenly modified under a particular ratio of the CRSS values on different systems, which may be achieved under a particular temperature and strain rate. Thus, the fabric transitions in limestone can be used as a geothermometer simultaneous with deformation. The numerical study shows that the catastrophic fabric transition similar to the experimental one from 200^0C to 300^0C occurs at the following border, CRSS ration $(f^-/r^-) = 0.738$ CRSS ratio $(e^+/r^-) + 1.221$. Across this border the activity of f^- systems tremendously increases by the consumption of those of e^+ (twinning) and r^- systems.

5804 Geochemistry

27339 (DOE/ER/13767–2) **Sedimentologic and diagenetic history of the Mission Canyon Formation (Mississippian) and stratigraphic equivalents, southwestern Montana and east-central Idaho and determination of rare earth element abundances in diagenetic carbonates: Technical progress report No. 2, March 15, 1988–March 14, 1989.** Dorobek, S.L. Texas A and M Univ., College Station, TX (USA). 15 Mar 1989. 6p. DOE

Contract FG05-87ER13767. Order Number DE89010002/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Mission Canyon Formation in southwestern Montana and its stratigraphic equivalents in east-central Idaho form an important stratigraphic sequence which was deposited during a critical stage in the evolution of the western continental margin of North America. This progress report presents data acquired since the beginning of DOE sponsorship of research on this sequence. Preliminary interpretations are presented in this report where the data set allows. This study will provide important information concerning the distribution and geometries of various lithofacies in the Mission Canyon Formation and its stratigraphic equivalents. The study area lies along the trend of the Mississippian platform margin and covers the Mississippian platform margin-to-basin transition. Our detailed sedimentologic studies have allowed us to understand the evolution of the platform margin-to-basin transition, an integrated petrographic and geochemical study of the Mission Canyon Formation is being carried out within the sedimentologic context established by field studies. Petrography and geochemical microanalyses provide nearly complete chemical characterization of diagenetic carbonates. These data are being used to interpret extent of diagenetic alteration, sources of ions incorporated into cements, and paleohydrology of diagenetic fluids. 5 refs.

27340 **Ages and Nd, Sr isotopic systematics in the Sierran foothills ophiolite belt, CA: the Smartville and Feather River complexes.** Shaw, H.F. (Lawrence Livermore National Laboratory, CA (USA)); Niemeyer, S. *Geological Society of America, Abstracts with Programs (USA),* 17: 714 (1985). (CONF-8510489–: 98. annual meeting of the Geological Society of America, Orlando, FL, US, October 28, 1985).

Sm-Nd dating has shown the Kings-Kaweah ophiolite to be ~ 480 My old. Its Nd, Sr, and Pb isotopic compositions require an unusually old depleted mantle source. Samples from the Smartville and Feather River complexes have been analyzed in a search for similar highly depleted, early Paleozoic ophiolites in the northern foothills ophiolite belt. Six whole rocks from Smartville, encompassing representative lithologies, plus plagioclase and pyroxene mineral separates define a 183 +/- 22 My Sm-Nd isochron. This age, interpreted as the igneous age, is older than, but within error of, ~ 160 My U-Pb ages previously obtained from plagiogranite zircon analyses. One diabase with unusually high Rb/Sr yields a depleted mantle Sr model age of 200 +/- 25 My, consistent with the Sm-ND age. These compositions are clearly oceanic in character but do not discriminate among possible tectonic settings for the formation of the Smartville complex. Sm-Nd data for flaser gabbros and related rocks from Feather River scatter about an ~ 230 My errorchron with $\epsilon_{Nd}(T)$ = +6.3 to +8.7. Initial $^{87}Sr/^{86}Sr$ ranges from 0.7028 to 0.7031. These results indicate a complex history with initial isotopic heterogeneities and/or disturbances of the isotopic systems. If primary, the ϵ_{Nd} (T) values are somewhat low, suggesting a possible arc origin for these rocks. Neither the Smartville nor Feather R. complexes appear to be related to the Kings-Kaweah ophiolite which, so far, is unique among foothill ophiolites in having an early Paleozoic age and a clear MORB, as opposed to arc or marginal basin, isotopic signature.

5805 Oceanography

27341 (MU/CCORE–1987) **C-CORE report of activities. 1986-1987.** Memorial Univ. of Newfoundland, St. John's (Canada). Centre for Cold Ocean Resources Engineering. 1987. 27p. (CE–02481). Available from Centre for Cold Ocean Resources Engineering, C-CORE, Memorial University of Nfld., St. John's, NF, Canada A1B 3X5; $N/C.

This report presents an overview of activities of the Centre for Cold Ocean Resources Engineering (C-CORE), an independeantly funded research centre located at Memorial University of Newfoundland, St. John's, whose mandate is to undertake research that will assist the safe and orderly development of Canada's resources in cold and ice frequented oceans. Ongoing funding comes from the federal government and industry. A description of a 5-year research plan (1987-1991) is given, divided into research projects in ice engineering, remote sensing, and seabed geotechnics. Program reports for these areas for 1986-87 are presented. Also included are a financial statement for the fiscal year ending March 31, 1987, and a list of publications for 1986 and 1987.

27342 **Sediment dispersal patterns within the Nares Abyssal Plain: observations from GLORIA Sonographs.** Shephard, L.E. (Sandia National Lab., Albuquerque, NM (USA)); Tucholke, B.E.; Fry, V.A.; Flood, R.E.; Searle, R.C. *Geological Society of America, Abstracts with Programs (USA),* 17: 714-715 (1985). (CONF-8510489–: 98. annual meeting of the Geological Society of America, Orlando, FL, US, October 28, 1985).

Features evident on GLORIA sonographs from the Nares Abyssal Plain suggest a sediment dispersal pattern for turbidity currents that varies temporally and spatially, resulting in randomly distributed turbidite deposits in the distal abyssal plain east of 64^{0}W. Regional variations in backscatter intensities across the abyssal plain are related to the frequency and thickness of near-surface silt beds, basement highs disrupting the seafloor, and subtle changes in surface and sub-surface bedforms related to low-relief turbidite flow paths, biologic activity, and possibly erosion. High backscatter intensities, prevalent west of 64^{0}W, are generally associated with those areas containing thicker silt beds and very regular subbottom reflectors on 3.5 kHz profiles. Low backscatter intensities, prevalent east of 64^{0}W, are associated with those areas containing thin silt beds or stringers with a much higher percentage of pelagic clay. Seafloor lineaments occur throughout the survey area but decrease in abundance east of 64^{0}W. These features have no apparent relief when crossed by surface-towed seismic reflection profiles. In some instances the lineaments may correspond to low-relief turbidite flow paths that contain varying textural compositions resulting in increased backscatter. These features would be indicative of sediment transport directions. Other possible origins for the lineaments, that often appear trackline parallel, include near-surface morphology that is preferentially detected and aligned by GLORIA, or possibly the lineaments result from complex subbottom interference patterns that would not be readily apparent in areas with a more irregular seafloor.

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6401 Astrophysics and Cosmology

Refer also to citation(s) 27065

27343 (AD-A–202653/2/XAB) **Geosynchronous high-energy electron (1.2 - 16 MeV) solar-wind correlation analysis. Master's thesis.** Grover, G.P. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 160p. (AFIT/GSO/ENP–88D-8). Available from NTIS, PC A08/MF A01.

This thesis investigated the relationship between high-energy electron (1.2-16 MeV) count rates and solar-wind velocity. The analysis used daily averages for all variables. Two data sets were examined: the first, slightly after solar maximum; the second, slightly before solar minimum. The electron count rate data came from DOD satellite 1979-053 in geosynchronous orbit while the solar-wind data were collected by other satellites directly in the unobstructed solar wind. Methods used to analyze the data were daily average plots, frequency plots, probability plots, descriptive statistics, linear correlation analysis of both original and percentiled data, and event analysis. The solar-wind velocity correlates differently with high-energy electron count rated depending on where in the solar cycle the solar-wind events occur. Through event analysis two to three days prior to a significant rise in high energy (1.2-16 Mev) electron count rates, a significant rise in solar wind velocity also occurred. However, due to the low linear correlation results achieved (all R-Squared values were less than 0.50), it is likely that solar-wind velocity is only one of several variables determining the occurrences of high-energy electron events at earth geosynchronous altitude.

27344 (AD-A–202895/9/XAB) **Directionality of continuum gamma rays from solar flares.** Bai, T. Stanford Univ., CA (USA). Center for Space Science and Astrophysics. 15 Nov 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Astrophysical Jnl., Vol. 334, No. 2, 1049-1053(15 Nov 1988).

Hard x-ray-burst spectrometer total counts as calibration are used to investigate how the brightness of gamma rays above 300 keV changes as a function of the heliocentric angle of a flare. The normalized gamma-ray brightness, on the average, increases with the heliocentric angle; a flare at the limb is estimated to be 13 times brighter in gamma rays than a similar flare near the central meridian. Both pancake-like electron distributions and downward beam distributions can be adjusted to produce the deduced limb brightening.

27345 (AD-A–203030/2/XAB) **Force-free magnetic fields: is there a loss of equilibrium.** Klimchuk, J.A.; Sturrock, P.A. Stanford Univ., CA (USA). Center for Space Science and Astrophysics. 6 Dec 1988. 31p. Available from NTIS, PC A03/MF A01.

This paper examines concept in solar physics that is known as loss of equilibrium in which a sequence of force-free magnetic fields, said to represent a possible quasi-static evolution of solar magnetic fields, reaches a critical configuration beyond which no acceptable solution of the prescribed form exists. This concept is used to explain eruptive phenomena ranging from solar flares to coronal mass ejections. Certain sequences of force-free configurations are discussed that exhibit a loss of equilibrium, and it is argued that the concept is devoid of physical significance since each sequence is defined a way that does not represent an acceptable thought experiment. For example, the sequence may be defined in terms of a global constraint on the boundary conditions, or the evolution of the sequence may require the creation of magnetic flux that is not connected to the photosphere and is not present in the original configuration. The global constraints typically occur in using the so-called generating function method. An acceptable thought experiment is proposed to specify the field configuration in terms of photospheric boundary conditions comprising the normal component of the field and the field-line connectivity. Consider a magnetic-field sequence that, when described in terms of a generating function, exhibits a loss of equilibrium and show that, when one instead defines the sequence in terms of the corresponding boundary conditions, the sequence is well behaved.

27346 (AD-A–203138/3/XAB) **Classification of solar flares.** Bai, T.; Sturrock, P.A. Stanford Univ., CA (USA). Center for Space Science and Astrophysics. Nov 1988. 82p. (CSSA-ASTRO–8820). Available from NTIS, PC A05/MF A01.

This paper is organized as follows. First the historical background before the SMM (Solar Maximum Mission) launch is discussed. Next, the recent developments made by observations with SMM, Hinotori, and other contemporary satellites and ground-based observatories are presented. Based on these observations, solar flares are classified into the following five classes: thermal hard X-ray flares, nonthermal hard X-ray flares, impulsive gamma-ray/proton flares, gradual gamma-ray/proton flares, and quiescent filament-eruption flares. The authors also discuss the roles of filament eruptions in flare development, as well as theoretical ideas related to processes occurring in different classes of flares.

27347 (ESA-SP–286, pp. 399-402) **Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies.** Ye-Ming, G. (Arizona Univ., Tucson (US). Dept. of Physics); Hill, H.A.; Rosenwald, R.D. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The asymptotic properties of the low-degree solar gravity modes are studied in the framework of first- and second-order asymptotic theory predictions. The results of this analysis demonstrate the necessity of retaining the second-order term in asymptotic theory to describe the eigenfrequency spectrum. In this theory, there are two first-order parameters, and two second-order parameters. There remain differences between the asymptotic theory eigenfrequencies and observed eigenfrequencies which are quasi-periodic functions of the radial order n for a given value of the degree l.

27348 (ESA-SP–286, pp. 393-398) **Searching for solar G-modes tests of a statistical method.** Fossat, E. (Nice Univ., 06 (France)); Grec, G.; Gavrjusev, V.; Gavrjuseva, E. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The solar g-modes are extremely difficult to detect because of their very small amplitude and because of the absence of any regular pattern in their frequency distribution. A frequency dependent noise power spectrum and a g-mode power spectrum can look extremely similar. We propose to use crosscorrelation and autocorrelation methods to test the presence of g-modes in a real power spectrum. This method is used on 3 years of ACRIM irradiance data with negative conclusion. It is also tested with synthetic g-modes computed into a standard and a non standard model. Only the standard model seems to offer enough regularity in rotational splitting and in period separation to make reliable the measurement of these two parameters.

27349 (ESA-SP–286, pp. 387-392) **Integrated light and velocity of solar G modes oscillations.** Provost, J. (Observatoire de Nice, 06 (France)); Berthomieu, G. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The properties of the integrated intensity and velocity variations of the solar gravity modes for different spatial filters are studied in the adiabatic and nonadiabatic cases in the frequency range 40-120 μHz. Predicted amplitudes are given assuming equipartition of energy between the modes. As far as the intensity is concerned, a lack of amplitude has been pointed out around 60μHz, which should have implication on the whole disc Virgo and ground based observations.

27350 (ESA-SP–286, pp. 487-504) **Helioseismological inverse problem: diagnostics of the structure of the lower solar atmosphere.** Brodsky, M.A.; Vorontsov, S.V. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The five-minute solar oscillation frequencies contain information about the phase shift corresponding to the reflection of the internal acoustic waves from the outer solar layers. The results of the reconstruction of the frequency dependence of the phase shift from the experimental data are described. This information provides the efficient way of seismic diagnostic of the structure of the outer regions of the convection zone and lower solar atmosphere. The method of direct computation of frequency dependence of the phase shift for a solar envelope model is described.

27351 (ESA-SP–286, pp. 481-486) **Oscillation frequencies of solar models.** Cox, A.N. (Los Alamos National Lab., NM (US)); Guzik, J.A.; Kidman, R.B. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Two solar models have been constructed, one with no diffusion of the atomic nuclei, and another including diffusive element separation. The opacity at the bottom of the convection zone was increased 15-20 percent (within its theoretical uncertainty) to obtain a few microhertz agreement with observed p-mode frequencies. Original helium mass fractions were 0.291 and 0.289 for the no-diffusion and diffusion models, respectively. The diffusion model evolved to a surface Y=0.256 at the solar age, and the original Z value of 0.0200 decreased to 0.0179. Agreement of l=0 and 2 p-mode frequency separations with those observed is good. The g-mode nonadiabatic solutions do not have equal period spacings until high radial order. The lowest order modes are more visible if they all have the same kinetic energy. High central temperatures,

produce over 9 SNUs from the B and 1.5 SNUs from the Be reactions. Models with iron condensed-out below the convection zone, and with WIMPs cooling the central regions to reduce the SNUs, agree less well with p-mode frequency separations.

27352 (ESA-SP–286, pp. 475-480) **Helioseismological inverse problem: sound speed in the solar interior.** Vorontsov, S.V. (AN SSSR, Moscow. Inst. Fiziki). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The asymptotic technique for the reconstruction of the sound speed distribution in solar interior from the observational frequencies of the five-minute oscillations is described. The significant improvement of the efficiency of reconstruction of the structure of the central solar regions is achieved due to the inclusion of the effects of self-gravitation into the asymptotic theory and due to the general improvement of the inversion technique. The results of the inversion of the experimental data are discussed.

27353 (ESA-SP–286, pp. 471-474) **Sound velocity distribution in the sun inferred from asymptotic inversion of p-mode spectra.** Shibahashi, H. (Tokyo Univ. (JP). Dept. of Astronomy); Sekii, T. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We solve the inverse problem of the solar p-mode spectrum based on a recently developed asymptotic inversion method, and infer the sound velocity distribution with the accuracy better than a few percent. In this method, the equation governing high order p-mode oscillations has been reduced to a form of the Schroedinger equation in quantum mechanics. By using the quantization rule based on the WKBJ method, we formulated an integral equation to infer the form of the "acoustic potential". The acoustic potential itself consists of two parts. One of them is dependent on the degree l and the sound velocity and is the dominant term in the deep interior while the other is independent of l and dominates in the outer envelope. By examining the l-dependence of the acoustic potential thus inferred, we separate these two terms and then we infer the sound velocity distribution in the Sun. We apply this method to the real observational data and obtain the sound velocity distribution in the Sun. We compare the result with our model and find that there is a small discrepancy between the model and the inferred result.

27354 (ESA-SP–286, pp. 457-470) **Scattering and Multiple Scattering of Acoustic Waves in a Stratified Medium.** Rosenthal, C.S. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics); Gough, D.O. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Bogdan and Zweibel have studied the effect on wave propagation of scattering from an ensemble of vertical magnetic flux tubes in a stratified atmosphere, using the WKB approximation. We analyse the effect of an ensemble of general axisymmetric scatterers on acoustic waves in a stratified atmosphere, without using the WKB approximation, and obtain a dispersion relation valid for small filling factors. The properties of this dispersion relation are studied for scattering from density inhomogeneities in a two-layer model atmosphere. It is found that increased stratification tends to decrease the frequency perturbation induced by a population of cylindrical inhomogeneities.

27355 (ESA-SP–286, pp. 451-456) **Current options for the equation of state of the solar interior.** Daeppen, W. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service d'Astrophysique). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The principal open problem of the equation of state is the number of excited states of hydrogen and helium in the zones of partial ionization. The number of excited states is affected in two ways: first by destruction of the levels due to the (neutral and charged) surrounding species, and second by statistical mechanics which governs the population of the available levels. I discuss recent progress in this field and explain the two principal current "philosophies". One is the chemist's view, in which bound systems are interpreted as autonomous species with reactions between each other, the other is the physicist's view, in which a virial expansion of pressure is obtained starting out from fundamental species only (i.e. electrons and nuclei), and in which the so-called Planck-Larkin partition function appears.

27356 (ESA-SP–286, pp. 431-450) **Study of solar structure based on p-mode helioseismology.** Christensen-Dalsgaard, J. (Aarhus Univ. (DK). Inst. Astronomisk). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

A principal goal of helioseismology is to test the physics, assumptions and procedures used in computing models of solar and stellar structure and their oscillation frequencies. Indeed, the connection between the physics and the assumptions on the one hand, and the observable frequencies on the other, may be regarded as the principal forward (and inverse) problem, with the model serving as a necessary intermediate step. Here I consider how the model and its frequencies react to changes in the physics and the assumptions. I also briefly discuss tests of numerical precision, and compare computed frequencies with the observations.

27357 (ESA-SP–286, pp. 419-430) **Search for solar gravity modes.** Henning, H.M. (Stanford Univ., CA (US). Center for Space Science and Astrophysics); Scherrer, P.H. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We have maintained a solar oscillations observing program for more than 13 years at Stanford. The observations are most sensitive to low degree solar modes and have been used for the study of long period p-mode and g-mode oscillations. At the start of the 1987 observing season (summer) some long-standing problems with the instrument were corrected which (along with good weather) allowed the cleanest set of data to date. This paper reports the current state of the search for evidence of g-modes in this data. Analysis of this data shows good evidence for g-modes. Various methods were used for mode identification with a statistical search for a simple-pattern of even spacing in period selected as the most robust. Using this method, a possible g-mode identification was made with an asymptotic period separation T0 = 37.1 minutes. This identification was consistent with a rotation splitting of 1.6 microHz. Tests with randomly generated spectral peaks find as significant a possible set of modes in only 2 out of 100 cases.

27358 (ESA-SP–286, pp. 415-418) **Properties of solar gravity mode signals in total irradiance observations.** Kroll, R.J. (Arizona Univ., Tucson (US). Dept. of Physics); Chen, J.; Hill, H.A. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Further evidence has been found that a significant fraction of the gravity mode power density in the total irradiance observations appears in sidebands of classified eigenfrequencies. These sidebands whose amplitudes vary from year to year are interpreted as harmonics of the rotational frequencies of the nonuniform solar surface. These findings are for non axisymmetric modes and corroborate the

findings of Kroll, Hill and Chen for axisymmetric modes. It is demonstrated that the generation of the sidebands lifts the usual restriction on the parity of the eigenfunctions for modes detectable in total irradiance observations.

27359 (ESA-SP–286, pp. 403-414) **Inversion of quasi-periodic deviations between low-degree solar gravity mode eigenfrequencies and asymptotic theory eigenfrequencies.** Hill, H.A. (Arizona Univ., Tucson (US). Dept. of Physics); Gao, Q.; Rosenwald, R.D. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The fine structure found by Gu, Hill and Rosenwald between asymptotic theory eigenfrequencies and the observed eigenfrequencies is interpreted as the result of conditions not being met for the applicability of asymptotic theory at one or more radii in the solar interior. From an inversion of the observed fine structure, reasonably good agreement is obtained between observation and theory for either a localized perturbation in internal structure at $r/R \sim 0.06$ or at $r/R \sim 0.23$. The latter solution is, however, the better one. The amplitude of the perturbation in the mean molecular weight required to produce the fine structure is also inferred.

27360 (ESA-SP–286, pp. 593-600) **Oscillations of Jupiter as a tool for probing its internal structure.** Mosser, B. (Observatoire de Paris, Section de Meudon, 92 (FR)); Gautier, D.; Delache, P. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The internal structure of Jupiter is still uncertain. According to current models the planet exhibits two discontinuities of sound speed in the interior. The first one located in the external part of the hydrogen - helium atmosphere corresponds to the transition of molecular to metallic hydrogen, while the second one to the transition between the H-He envelope and the high density core. We use method of ray tracing of acoustic modes to predict the behaviour of expected pressure modes of Jupiter. Due to the inner discontinuity, the regular spacing between frequencies of adjacent models is broken in a characteristic manner which provides a clear signature. Observations of low degree p-modes, achievable from the ground, would accurately provide the value of the radius of the planetary core. Observations of high degree modes would provide a signature of the external transition.

27361 (ESA-SP–286, pp. 587-592) **Search for radial velocity variations in rapidly oscillating Ap stars using the Fabry-Perot interferometric stellar oscillation spectrometer (FP-ISOS).** Leeper, M. (Imperial Coll. of Science and Technology, London (UK). Blackett Lab.); Bell, C.R.; Pietraszewski, K.A.R.B.; Renton, R.E.; Belmonte, J.A.; Palle, P.L.; Roca Cortes, T. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Radial velocity measurements were taken of a group of Ap stars using a newly improved FP-ISOS. Observations were made using the 1.5m TCS on Tenerife in May 1987 and December 1987. The already known Rapidly oscillating Ap stars 33 Lib and HR1217 were observed in order to search for radial velocity variations corresponding to the photometric periods found in these stars. Simultaneous photometric measurements were made on HR1217 on the last two nights using the nearby 0.5m telescope. The radial velocity and photometric data sets have been reduced using a weighted sine wave fitting routine. Promising results have been obtained for HR1217, while results obtained for the other Ap stars observed do not allow to any conclusion.

27362 (ESA-SP–286, pp. 575-578) **Variable star statistics in open clusters. NGC 6192.** Frandsen, S. (Aarhus Univ. (DK)); Kjeldsen, H. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

A search for δ-Scuti stars and other variables in open cluster is in progress, and we report results for the cluster NGC 6192. At the end the statistics for a number of open clusters on the frequency of variables in the instability strip is presented. We think that there is now increasing evidence for a change with age of the fraction of variables.

27363 (ESA-SP–286, pp. 583-586) **High precision velocity measurements of procyon using the 7699 A line of potassium.** Innis, J.L. (Birmingham Univ. (UK). Dept. of Physics); Isaak, G.R. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The Star Procyon (α CMi) was observed for 2 weeks using the Birmingham double magneto-optical filter spectrometer on the 1.9 m reflector of the South African Astronomical Observatory in 1988 January. Our analysis of these velocity data shows that the noise level in the power spectrum of the combined nightly runs is approximately 12 $m^2 s^{-2}$. These data were searched for the presence of small scale oscillations, but none were obviously present. On one night the surface integrated magnetic field of Procyon was measured using a rotating quarter wave plate to select alternatively opposite senses of circularly polarised light.

27364 (ESA-SP–286, pp. 563-574) **Search for solar-type oscillations in other stars using the Michelson interferometric stellar oscillation spectrometer (ISOS).** Pietraszewski, K.A.R.B. (Imperial Coll. of Sciences and Technology, London (UK). Blackett Lab.); Renton, R.E.; Ring, J. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The many years that have passed since the first detection of 5-minute periodicities in the Sun have seen an explosive increase in the attention lavished upon the measurement and interpretation of this phenomenon. To extend such attention to other solar-type stars has long been the goal of many workers. So far the measurements have been inconclusive but not discouraging; the great reduction in photon flux and the total lack of spatial resolution making this task far from trivial. The key to future success lies in significantly improving the signal-to-noise ratio of the measurements. This has been successfully done with the Michelson ISOS by using the many suitable absorption lines in a 400A band of spectrum.

27365 (ESA-SP–286, pp. 579-582) **Solar calibration of asteroseismology.** Gelly, B. (Stanford Univ., CA (US). Center for Space Science and Astrophysics); Fossat, E.; Grec, G.; Schmider, F.X. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The first expected result of asteroseismology will consist in the measurement of two parameters, $\Delta\nu$ and D_0, which in the Tassoul's asymptotic approximation are close to the sound speed integral across the solar radius, and to the sound speed gradient inside the nuclear burning core, respectively. The first depends mostly on the mass and evolves slowly with age, while the second is strongly age dependent through the increase of molecular mass in the stellar core. Theorists have started to build $\Delta\nu$ - D_0 diagrams, as a tool for the determination of mass and age of stars. For a precise calibration of such a diagram we have made a precise measurement of those parameters in the case of the sun.

27366 (ESA-SP–286, pp. 551-562) **Rapid photometry of the δ Scuti variable 63 Her.** Mangeney, A. (Observatoire de Paris,

Section de Meudon, 92 (FR)); Chevreton, M.; Daeppen, W.; Saint-Pe, O.; Praderie, F.; Alvarez, M.; Belmonte, J.A.; Roca Cortes, T.; Fuensalida, J. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The δ Scuti variable 63 Her has been observed during 21 nights at two observatories (Observatorio del Teide, Tenerife Island, Spain and Observatorio Astronomico Nacional de San Pedro Martir in Baja California, Mexico). Six frequencies of pulsation have been unambiguously detected, among which the fundamental radial mode, two non radial pressure-like modes and probably three gravity like modes.

27367 (ESA-SP–286, pp. 547-550) **Observed p-Mode spectra of Ap stars and the Sun.** Matthews, J. (British Columbia Univ., Vancouver (CA). Dept. of Geophysics and Astronomy). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Five rapidly oscillating Ap (roAp) stars have shown evidence of multiple p-mode pulsations in their light or radial velocity variations for which estimates of their fundamental frequency spacing $\Delta\nu_0$ can be made. These stars and the Sun have ratios of $\Delta\nu_0/\nu$ which fall near 0.025 and 0.04. Since $\Delta\nu_0/\nu$ should be roughly proportional to $1/(n + l/2)$, it is possible that there are common selected overtone regimes for the pulsations of the roAp stars and the Sun.

27368 (ESA-SP–286, pp. 539-546) **Effect of a Nonspherical Sound Speed on the Acoustic Frequency Spectrun of the Sun.** Kosovichev, A.G. (Cambridge Univ. (UK). Inst. of Astronomy); Perdang, J. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We study the effect on the solar acoustic frequency spectrum of a localised deviation from spherical symmetry concentrated near the outer convective zone of the sun. The local asymmetry is modelled by an angular-dependent contribution to the sound speed. Our results are indicative that even slight local asymmetries influence the precise positions of the frequencies. They suggest the possibility of a diagnosis of nonspherical in the structure of the sun.

27369 (ESA-SP–286, pp. 533-538) **Determination of the solar sound speed by an asymptotic inversion technique.** Kosovichev, A.G. (Cambridge Univ. (UK). Inst. of Astronomy). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

A new asymptotic inversion technique is developed using a weighted least-squares bicubic spline fit to the observational data. The accuracy of the asymptotic approach is discussed, and it is shown that the asymptotic theory is adequate to determine the sound speed in the solar interior between 0.4 and 0.9 R. The inversion of the data of Duvall et al. (1988) shows that the sound speed between 0.4 and 0.7 R is about 1 per cent greater than it is in the standard solar model 1 of Christensen-Dalsgaard (1982); this result is in agreement with the previous asymptotic inversion of Christensen-Dalsgaard et al. (1985) and also that of Christensen-Dalsgaard et al. (1988). It is also consistent with the inversions presented by Gough and Kosovichev (1988) using a kernel function approach.

27370 (ESA-SP–286, pp. 529-532) **Convection and p-mode oscillations.** Stein, R.F. (Michigan State Univ., East Lansing (US). Dept. of PHysics and Astronomy); Kuhn, J.R.; Nordlund, A. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We have simulated the upper 2.5 Mm of the solar convection zone using a three-dimensional, compressible, hydrodynamic computer code. Preliminary results show that convection excites p-mode oscillations. The frequencies of the modes in the numerical simulation agree well with the eigenfrequencies of our computational box calculated for the time averaged mean atmosphere. The agreement is excellent at low frequencies, and diverges at higher frequencies in a manner similar to the difference between observed and theoretical frequencies for the sun.

27371 (ESA-SP–286, pp. 525-528) **Solar oscillations: overshoot at the base of the convection zone.** Skaley, D. (Freiburg Univ. (DE)); Stix, M. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Solar models are calculated with the non-local form of mixing length theory applied to the lower part of the convection zone. The resulting overshoot layer has a depth of 16 Mm, this is about 30% of the local pressure scale height. The parameters α (mixing length/pressure scale height) and the initial He-abundance Y_0 are obtained by calculating a full model sequence in time. The total convection zone has the depth d = 197 Mm at a temperature T = 2.166 MK compared to d = 181 Mm and T = 1.927 MK in the local case. This fact may have implications on the observed low Li-abundance. The influence of the overshoot layer on low-l modes shows an increase in the frequencies thus lowering the difference to the observed frequencies. For intermediate-l modes where the reflection boundary is just below the overshoot region the effect is strongest. High-l modes are slightly lowered by the overshoot effect.

27372 (ESA-SP–286, pp. 521-524) **Inversion method based on the Moore-Penrose generalized inverse matrix.** Sekii, T. (Tokyo Univ. (JP)); Shibahashi, H. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We present an inversion method based on solving the algebraic equations by means of the Moore-Penrose generalized inverse matrix of inferring the solar internal rotation, and evaluate its validity.

27373 (ESA-SP–286, pp. 517-521) **Solar variability and climatology.** Rozelot, J.P. (Observatoire des Alpes Maritimes, 06 - Grasse (FR)). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Planetary surface temperature is determined by the balance between absorbed solar and outgoing infrared radiation, it is not surprising that climate modelers have theorized that climate changes are driven by changes in solar luminosity S. Direct measurements of this parameter from above the atmosphere, have been available since early 1980 from the ACRIM instrument onboard the SMM satellite. Based on these data, a cluster of 10 periodicities can be found. From the two data sets, it is easy to deduce the relationship between UT 1 and S, a quadratic curve being obtained. As a conclusion, it is suggested that for long periods, climate is influenced by astronomical cycles, and mainly by variations in the elements of the Earth's orbit (Milankovitch variables); for short periods, fluctuations in Earth rotation is dominated by atmospheric effects (changes in the net atmospheric rotation rate); between these two fields, the sun activity cycle may affect the Earth, through the variation of the solar luminosity.

27374 (ESA-SP–286, pp. 513-516) **Further implications of solar p-modes as measured in Na and K resonance lines.** Palle, P.L.; Perez Hernandez, F.; Roca Cortes, T. European Space

Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The ratios between the amplitudes of p-modes measured simultaneously in the Na and K resonance lines are compared with the expected ratios for adiabatic waves at two different levels in the atmosphere. The results agree within errors with the energy decaying solution for the waves at the photosphere.

27375 (ESA-SP–286, pp. 511-512) **Modelling the variation of solar p-mode frequencies.** Daeppen, W. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service d'Astrophysique); Turck-Chieze, S.; Gough, D.O. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We present a Green's function technique to study long-term variations of the Sun (with characteristic time scales from one month to millions of years). The method is the combination of two previous analyses carried out independently by Gough and by Daeppen. Our study has been motivated by the recent observational progress on solar p-mode frequency variations.

27376 (ESA-SP–286, pp. 505-510) **Further progress on the helium abundance determination.** Daeppen, W. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service d'Astrophysique); Gough, D.O.; Thompson, M.J. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We report on further progress in attempting to determine the helium abundance in the solar convection zone by analysing the position and shape of the 'helium hump' in a thermodynamic quantity which can be inferred from the sound speed in the vicinity of the He II ionization zone. At present we are estimating the sound speed from frequencies of high-degree oscillations by a differential asymptotic technique. The helium abundance Y is then determined by fitting the hump inferred to one obtained by interpolation in a grid of theoretical model envelopes. We have tested the procedure by carrying out a double-blind experiment on artificial data, and have found that accurate knowledge of the equation of state is essential for a useful determination. We have also carried out the procedure on real solar data, but we judge that the frequencies are at present too poorly determined to enable us to obtain a reliable estimate of Y in the sun.

27377 (ESA-SP–286, pp. 673) **Modelling the solar oscillation time series by a randomly excited oscillator.** Delache, P. (Observatoire de la Cote d'Azur, 06 - Nice (FR)); Fossat, E.; Lazrek, M. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

If the individual solar oscillations were pure standing waves of constant amplitude inside a stationary Sun, there would be in principle no intrinsic limits to the accuracy with which their frequencies could be measured. This paper deals with artificial full disk data. The goal is to determine the parameters of a randomly excited oscillator by comparison with the best data available to us. Such artificial signal is then used to test the methods of analysis used for the precise determination of mode frequencies, amplitudes and linewidths. We present tests of the reliability of centroid measurements made by barycenter, Lorentzian fit, Gaussin fit, with and without background noise. Several methods are also tested for linewidth measurements.

27378 (ESA-SP–286, pp. 671-672) **Effects of convective velocities on solar pressure mode frequencies.** Delache, P. (Observatoire de la Cote d'Azur, 06 - Nice (FR)); Fossat, E. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

There are persistent discrepancies between observations and theoretical calculations of solar p-mode frequencies, in spite of improvements in the theory (e.g. equation of state). In this short communication, we propose to approximate roughly the difference (observation-calculation) versus frequency. It has been already suggested that "Solar p-mode eigenfrequencies are decreased by turbulent convection". We want to revisit this suggestion and reformulate it. After a brief discussion of the mechanism, we present an order of magnitude evaluation which shows that, indeed, it is worthwhile to pursue the idea further: this will be done in improving the description of the coupling between convection and oscillations.

27379 (ESA-SP–286, pp. 661-670) **Influence of the equation of state on the zero-age main sequence and the sun.** Lebreton, Y. (Observatoire de Paris, Section de Meudon, 92 (FR)); Daeppen, W. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

In the light of the present uncertainty in the equation of state of stellar interiors, we have calculated stellar and solar models using three different formalisms for the equation of state. We have considered (1) a mixture of ideal gases using an artificial pressure-ionization device, (2) an equation of state where pressure ionization is achieved by the confined-atom model, and (3) an equation of state containing a large number of atomic and ionic species, with detailed internal partition functions, containing weighted occupation probabilities. We have examined the effect of these equations of state on the position of a star in the H-R diagram: the result is either a displacement of the star on the zero-age main sequence (ZAMS) or, for masses lower than 0.7 solar mass a change in the slope of the ZAMS. Furthermore we have carried out the usual calibration procedure in order to obtain the initial He abundance Y of the solar model.

27380 (ESA-SP–286, pp. 657-660) **Radial vibrations in 5 solar mass hydrogen-helium star.** Kirbiyik, H. (Middle East Technical Univ., Ankara (TR)). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

A model of first-generation intermediate mass star of 5 solar mass with no metals has been considered. The vibrational instability of this model has been investigated. The model, in question, burns helium in the core. Calculations have been performed for the first and second harmonics as well as for the fundamental mode. The model has been found to be vibrationally stable toward radial pulsations.

27381 (ESA-SP–286, pp. 649-656) **Mass-luminosity relationship for solar-type stars.** Van Altena, W.F. (Yale Univ., New Haven, CT (US). Observatory); Lee, J.T. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The mass-luminosity relationship for solar-type stars has been reinvestigated using data from the new edition of the Yale Parallax Catalogue and recently published orbits and mass ratios for the relevant visual double stars. The results of this investigation confirm that to within the errors of the data, the sun lies essentially on the mean relationship for the nearby stars. If there is to be further progress in the definition of the mass-luminosity relationship, then the accuracy of the trigonometric parallaxes must be improved substantially.

27382 (ESA-SP–286, pp. 643-648) **Solar-like oscillations in late spectral class stars.** Cox, A.N. (Los Alamos National Lab., NM (US)); Cahn, J.H. European Space Agency, 75 - Paris (France).

Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

We investigate the minimum mass star that can exhibit solar-like nonradial p-mode oscillations. Solar models have almost equal pulsational driving and damping due to standard radiative effects. Coupling with surface convective elements occasionally tips the balance by strongly driving for a few days modes with convection timescales at the top of the convection zone. Then both convective and radiative damping decrease the mode amplitude at an observed decay rate until the next convective reexcitation. Population I stellar models at 0.30, 0.45 and 0.75 solar mass have been constructed to see if they have a near equality of radiative driving and damping also. If so, then stars down to late spectral class could possibly display solar-like oscillations. We find that the near equality of radiative driving and damping occurs down to about 0.5 solar mass. Possibly 100 to 300 second oscillations can be observed through most of the K spectral class, if magnetic activity does not overwhelm these small amplitude nonradial pulsations.

27383 (ESA-SP–286, pp. 637-642) **End points of stellar evolution investigated by seismology on white dwarf stars.** Solheim, J.E. (Tromsoe Univ. (NO)). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

Astroseismological methods can be used to calibrate the white dwarf stage of stellar evolution. The internal structure of the white dwarfs can be investigated and the cooling rate determined. Comparing evolutionary models with the luminosity distribution of nearby white dwarfs make a local determination of the age of the galactic disk population possible. The white dwarf pulsators have multiple and closely spaced periods which can only be determined from continuous photometry covering several nights of observing. A campaign involving observatories around the world has been initiated and some first results are presented.

27384 (ESA-SP–286, pp. 629-636) **High mass loss in the young sun.** Turck-Chieze, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service d'Astrophysique); Dappen, W.; Casse, M. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The consequences of a possible mass loss in the early main sequence stage of solar type stars are investigated. Special attention is given to the Sun, the constraints from surface abundances and p-mode observations are taken into account. Only a total mass loss smaller than 0.2 sun mass seems to be consistent with the observations. Though the ensuing modifications of the internal structure and the cosmological consequences are very small, the ^{3}He, ^{7}Li, ^{9}Be surface abundances are significantly modified.

27385 (ESA-SP–286, pp. 623-628) **Asymptotic approximations of non-radial oscillation modes of the sun.** Tassoul, M. (Montreal Univ., Quebec (CA). Dept. of Physics); Smeyers, P.; Briers, R.; Degryse, K.; Polfliet, R.; Van Hoolst, T. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

An asymptotic approximation of higher-degree p-modes in the Sun with periods near 5 minutes is developed. As a starting point, the property is used that the inner boundaries of the acoustic resonant cavities in which these modes originate, are located at depths in the solar interior where the local acoustic frequency becomes equal to the angular frequencies considered. The treatment is based on Olver's asymptotic theory for second-order differential equations containing a large parameter. The equation determining the eigen-frequencies agrees with the equation derived earlier by Gough by the use of ray theory. The transition to the equation determining eigen-frequencies of higher-order p-modes is also considered.

27386 (ESA-SP–286, pp. 621-622) **On the thermal surface boundary condition for solar pulsations.** Gabriel, M. (Liege Univ. (BE). Inst. d'Astrophysique). European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

The numerical coefficient which appears in the thermal surface boundary condition of radial and nonradial oscillations is computed for the Sun.

27387 (ESA-SP–286, pp. 609-620) **Search for rapid oscillations in the northern Ap stars HD62140, HD81009 and HD22374.** Belmonte, J.A.; Palle, P.L.; Roca Cortes, T.; Shoch, F. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

High-speed photometric observations have been performed of the Ap stars HD62140, HD81009 and HD22374 for more than 60 hours in October and December 1986 using the 1m-JKT at the Observatorio del Roque de los Muchachos (ORM) and the 1.5m-TCS of the Observatorio del Teide (OT), Canary Islands (Spain). Photometric measurements in the B band were reduced and the residuals obtained were subjected to a harmonic analysis searching for periodicities in the range of a few minutes to 2 hours. There is some evidence that the star 49 Cam is oscillating. HD81009 and HD22374 were observed in order to confirm some traces of oscillation present in earlier observations however, these possible oscillations did not repeat in the new data.

27388 (ESA-SP–286, pp. 601-608) **Prototype stellar photometer for magnetic field and doppler measurements.** Cacciani, A. (Rome Univ. (IT)); Catalano, S.; Rodono, M.; Costa, G. European Space Agency, 75 - Paris (France). Dec 1988. (CONF-8809146–: Symposium on seismology of the sun and sun-like stars, Puerto de la Cruz, ES, September 26, 1988). In *Seismology of the sun and sun-like stars.* Order Number DE88757349/JAW. Available from NTIS (US Sales Only), PC A99/MF A01.

A stellar photometer is in preparation as a joint project of the University of Rome and the Astrophysical Observatory of Catania. It is based on a suitable version of the Magneto-Optical Filter (MOF). The aim is to detect magnetic and velocity signals on stars. The basic idea is shown in the figure. The photometer is able to maximize the collection of photons. As far as the magnetic field measurement is concerned we consider only the transverse component of the magnetic field that should provide detectable U and Q Stokes parameter (linear polarization). Tests on the sun are part of this program.

27389 (INIS-BR–1458, pp. 96) **Gamma-ray astronomy at the highest energies.** Weekes, T.C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COSMIC GAMMA SOURCES/pev range; COSMIC GAMMA SOURCES/tev range; TELESCOPE COUNTERS/cosmic ray detection; GAMMA ASTRONOMY

27390 (INIS-mf–11400) **Dynamics of the solar system. Proceedings. Vol. 3.** Sidlichovsky, M. (ed.). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. 211p. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The conference proceedings contains a total of 31 papers of which 7 have not been incorporated in INIS. The papers mainly discuss the mathematical methods of calculating the movement of planets, their satellites and asteroids in the solar system and the mathematical modelling of the past development of the solar system. Great attention is also devoted to resonance in the solar system and to the study of many celestial bodies. Four papers are devoted to planetary rings and three to modern astrometry. (M.D.). 63 figs., 10 tabs., 520 refs.

27391 (INIS-mf–11400, pp. 43-45) **Efficiency of various methods of the search for periodic orbits.** Hadrava, P. (Ceskoslovenska Akademie Ved, Ondrejov. Astronomicky Ustav); Kadrnoska, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The periodic orbits in circular restricted three-body problem are calculated using different numerical as well as analytical methods. The efficiency of both kinds are compared in this contribution. The improvement of analytical methods can be achieved by artificial splitting of the perturbation term. The analytical approximations are thus sufficiently, accurate even for large values of mass ratio μ. These approximations are also used to advantage as a zero-order approximation in numerical codes for seeking periodic orbits. (author). 2 figs., 2 tabs., 6 refs.

27392 (INIS-mf–11400, pp. 49-57) **Orbital resonances amongst planetary satellites.** Ferraz-Mello, S. (Sao Paulo Univ., SP (Brazil)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Work devoted in the past 15 years to the construction of formal theories of the motion of resonant satellites is summed up. The importance of formal theories and fundamental concepts are also discussed. The kernels derived by Jefferys and Ries, Sessin and Hori for the construction of formal theories for mutually perturbing satellites are considered. Some recent results concerning the determinations of the parameters of libration of several systems as well as the accelerations of the Galilean satellites and of Mimas are also presented. (author). 4 figs., 2 tabs., 60 refs.

27393 (INIS-mf–11400, pp. 71-73) **On the force function's transformation in the three-body problem.** Shkodrov, V.G. (Bylgarska Akademiya na Naukite, Sofia); Dikova, S.D. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The force function's transformation is dealt with in the general three-body problem in Jacobi's coordinates. In this transformation Rose's theory of the translation of spherical functions in quantum electrodynamics is used. (author). 2 figs., 4 refs.

27394 (INIS-mf–11400, pp. 27-32) **Resonances in the solar system and in planetary systems.** Hadjidemetriou, J.D. (Thessaloniki Univ. (Greece)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Recent work is presented on resonant motion in the solar system and in planetary system. The physical models used and the uderlying mathematical theory are also presented. The relation between resonance and instability is studied and the mechanism of the generation of instability is discussed and is related to the various parameters of the system. (author). 2 figs., 60 refs.

27395 (INIS-mf–11400, pp. 63-69) **Resonant motions of systems of rigid bodies in the solar system.** Barkin, Yu. V. (N.E. Bauman High Technical School, Moscow (USSR). The Chair of Theoretical Mechanics). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A constructive method has been developed for deriving periodic and conditionally periodic solutions of non-autonomous multi-frequency oscillatory systems and the planetary version has been found to the n+1 problem of rigid bodies. This method is used to explain the observed resonance motion of the planet Venus. Also developed is the analytical theory of the Moon's rotation and dynamic consequences have been predicted of resonances in the motion of the Moon. (M.D.) 19 refs.

27396 (INIS-mf–11400, pp. 33-37) **Comparison of perturbation and wisdom methods for 5/2 resonances.** Sidlichovsky, M. (Ceskoslovenska Akademie Ved, Prague. Astronomicky Ustav). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Some preliminary results are presented of the perturbation method applied to the 5/2 asteroidal resonance with Jupiter. The results are compared with those obtained by the author with the Wisdom method previously applied to this resonance by Sidlichovsky, M., and Melendo, B., Bull. Astron. Inst. Czech. (1986) v. 37(2) p. 65-80. Conclusions are arrived at relating to the origin of the corresponding Kirkwood gap. (author). 5 figs., 16 refs.

27397 (INIS-mf–11400, pp. 39-41) **Note on Lemaitre's model for third order resonance.** Pauwels, T. (Koninklijke Sterrenwacht van Belgie, Brussel (Belgium)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

In recent papers Henrard and Lemaitre have studied what they call "The Second Fundamental Model for Resonance" and its higher order generalizations. The action integral ("area index") was calculated analytically, but the phase space and the action integral as a function of the parameter δ were only plotted on scale by a computer. By using properties of quartic equations, however, the mathematically special values of δ were found. For third order resonances, one of these turned out to correspond to a minimum in the value of the "area index" A_2, but since it is very shallow and very close to the starting point of the function, this feature was invisible in Lemaitre's plots. This has some theoretical implications for the process of capture into a third order resonance, although numerically the effect will be small due to the shallowness of the minimum. A similar on first and second order resonance exercise revealed no new features. (author). 2 figs., 1 tab., 3 refs.

27398 (INIS-mf–11400, pp. 23-26) **Hamiltonian chaos in perturbed resonance problems.** Henrard, J. (Facultes Universitaires Notre-Dame de la Paix, Namur (Belgium)); Lemaitre, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A perturbative method is described for problems with two critical arguments developed elsewhere (Henrard, J., and Lemaitre, A., Celest. Mech., 39, 213-238, 1986). This perturbative method is based upon the numerical evaluation of a set of angle-action variables valid globaly on the phase space of a one-degree of freedom resonance problem. Applied to resonance 2/1 of the elliptic restricted planar three body problem, this perturbative method enables us to distinguish two mechanisms of the formation of chaotic behavior

and to identify features found in numerical experiments by previous authors. Questions relative to the formation of Kirkwood gaps in the asteroid belt are also briefly reviewed. (author). 1 fig., 38 refs.

27399 (INIS-mf–11400, pp. 59-61) **Calculation of spin-orbital resonance effects in lunar motion by the method of numerical integration.** Krasinskij, G.A. (AN SSSR, Leningrad. Inst. Teoreticheskoj Astronomii). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A simplified method to model lunar resonance spin-orbital interaction is developed for numerical integration by which orbital equations are integrated separately from rotational ones; however, no fictions secular perturbations arise in the longitude or node. (author). 2 figs., 3 refs.

27400 (INIS-mf–11400, pp. 77-87) **Long term energy variations and a 31 MYR effect in the orbits of the outer planets.** Nobili, A.M. (Pisa Univ. (Italy). Ist. di Matematica); Milani, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Long term numerical integrations of the orbits of the outer planets within the LONGSTOP research project, combined with an adequate processing and filtering of the output, have allowed to recover so far unknown variations in the major semiaxes of the planets over a period of about 1 million years. An attempt at computing the same variations analytically has shown that small divisors in mean motion can significantly increase the amplitude of a secular effect. The secular frequency of these energy variations involves the pericentres of Jupiter and Uranus and turns out to play a major role in shaping the dynamical structure of the outer solar system. It also appears in a secular small divisor of much a longer period (about 31 million years) recovered from the output of the 100 million years integration LONGSTOP 1B. This very small divisor seems to be responsible for the accumulation of spectral lines in some regions of the long-period spectrum of the outer solar system. The accumulation of spectral lines is known to be related to the presence of non regular regions of motion in the phase space. These findings have stimulated us to revisit the old problem of regular and non-regular motion of planetary orbits from the viewpoint of both the convergence of the series of classical secular perturbation theories and the modern concept of predictability horizon for non-integrable dynamical system. (author). 10 figs., 27 refs.

27401 (INIS-mf–11400, pp. 89-94) **Quasi resonant terms in secular variations planetary theories.** Bretagnon, P. (Bureau des Longitudes, Paris (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Secular variations planetary theories constructed at the Bureau des Longitudes use either order by order methods (with respect to the masses) or iterative methods. In all cases, the convergence of the solutions with respect to the masses is slackened by the upcoming of quasi resonant terms giving smaller and smaller divisors. This shows how difficult it is to get very precise solutions over long time spans such as several thousands of years. On the other hand, if the quasi resonant terms is locally developed with respect to time, very precise analytical solutions can be obtained over reduced time spans. An analytical solution has been therefore undertaken for the time span 1950 to 2050, aiming at a 30 meter precision on the position of the Earth with respect to the barycenter of the solar system. This precision is in fact needed for the comparison to the millisecond pulsar data. (author). 6 tabs., 5 refs.

27402 (INIS-mf–11400, pp. 95-98) **Secular evolution, proper modes and resonances in the inner ssolar system.** Laskar, J. (Bureau des Longitudes, Paris (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The secular system of the 8 main planets of the solar system has been computed up to order 2 and degree 5. It was numerically integrated over 30 millions years and Fourier analysed to obtain a solution similar to the results of analytical theories. The fundamental secular frequencies are computed with estimated accuracy. Our solution NGT (Numerical General Theory) fits well with Bretagnon's previous solution over 1 million years but presents great differences over longer time spans due to resonances in the secular system not properly taken into account by analytical methods. This is especially visible in the comparison of the proper modes solutions. (author). 2 figs., 1 tab., 12 refs.

27403 (INIS-mf–11400, pp. 99-101) **Alanytical approach to the time transformation TDB-TDT.** Fairhead, L. (Bureau des Longitudes, Paris (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

An analytical formula for the time transformation TDB-TDT (Temps Dynamique Terrestre, Temps Dynamique Barycentrique) valid over a few thousand years around J2000 has been computed with accuracy at 1 ns level. This computation was carried out by integrating the differential equation derived from a general metric. The transformation TDB-TDT is independent of the PPN (Parametrised Post Newtonian) parameters, γ and β, and of the 3 most commonly-used coordinate systems (standard, isotropic, Painleve), at least at the 1 ns level. The analytical theories ELP2000 (lunar) and VSOP82 (planetary) developed at the Bureau des Longitudes were used for motions of the solar system bodies. Furthermore, the numerical procedures described by Hellings and Davis to calculate this transformation yield results differing from our own procedure. These differences are due to the long-period terms of the planetary theories which are averaged out in numerical procedures. These terms are generated by resonances in the Solar System. (author). 13 refs.

27404 (INIS-mf–11400, pp. 105-112) **Secular and mean motion resonances in the asteroidal belt.** Scholl, H. (Observatoire de Nice, 06 (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The physics of the two types of resonances characterizing the dynamical structure of the asteroidal belt is presented. In the case of mean motion resonances, the frequency of Jupiter's rotation about the Sun determines the various resonance frequencies. For secular resonances, the resonance frequencies correspond to eigenfrequencies of the system of differential equations describing the motions of nodal and apsidal lines of planetary orbits. Both types of resonances are related to gaps in the asteroidal belt. The competing theories for the formation of these graps are reviewed. The secular resonances gained considerable interest because of their alleged role as source of Earth-crossing objects like Apollo asteroids and meteorites. Recent numerical model calculations on secular resonances are reviewed with this aspect in mind. (author). 7 figs., 40 refs.

27405 (INIS-mf–11400, pp. 113-120) **Chaotic behaviour of resonant motion in the solar system.** Froeschle, C. (Observatoire de Nice, 06 (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Chaotic behaviour in the solar system is very often connected with resonance. Great progress has been made in the last few years to relate the existence of the Kirkwood gaps with chaos. Use

of mappings has allowed cheap computations over millions of years. Unexpected intermittent increase of orbital eccentricities due to the existence of thin chaotic zone provides a mechanism for planetary close approach. However semi-analytical developments show that at least for the 2/1 resonance the problem remains open. Chaotic rotations of satellites like Hyperion or Miranda and chaotic motion of comets in nearly parabolic orbits are predicted and some physical implications discussed. Both comet Halley and Hyperion appear to be good candidates for real examples of dynamical chaos in the solar system. (author). 2 figs., 37 refs.

27406 (INIS-mf–11400, pp. 121-124) **On the origin of gaps in the distribution of minor planets.** Ferraz-Mello, S. (Sao Paulo Univ., SP (Brazil)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

An analytical averaging theory founded on the elliptic restricted three-body problem and valid for libration motions shows that there are forbidden intervals in the distribution of the mean semi-major axes at resonance (p+1):p. The actual asteroids may cross these gaps but they cannot remain there. Some 15 of the presently known Hildas are in the gap and some of them may cross it completely. The Griquas are presently at the left of the gap but some of them periodically cross the gap. (author). 4 figs., 1 tab., 10 refs.

27407 (INIS-mf–11400, pp. 125-128) **Chaotic motion in secular resonances.** Froeschle, C. (Observatoire de Nice, 06 (France)); Scholl, H. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The possible occurence is investigated of chaotic motion at secular resonances ν_5, ν_6 and ν_{16} integrating model asteroids and known asteroids over some Myrs. At resonances ν_5 and ν_{16} transitions are found between libration, inner and outer circulation. In the case of mean motion such transitions are resonances related to chaotic motion. Chaotic motion is also indicated by a temporary location in resonances ν_6 and ν_{16}, as well as in resonances ν_5 and ν_{16}. Chaotic motion is also indicated by close approaches to Jupiter such as the ν_6 resonant asteroid (2368) Beltovata. The calculation of corresponding maximum Lyapunov exponents would confirm our conjecture concerning the occurence of chaotic motion at secular resonances. (author). 5 figs., 1 tabl, 7 refs.

27408 (INIS-mf–11400, pp. 151-157) **Role of resonances in planetary rings.** Borderies, N. (California Inst. of Tech., Pasadena (USA)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The new observations of planetary rings, including those acquired during the encounters of Voyager with Jupiter, Saturn and Uranus and the discovery of incomplete rings around Neptune, reveal the great importance of resonances in determining the dynamics and the shape of planetary rings. Several types of resonances play a part in planetary rings. Current questions of interest are related to the nonlinear theory of density waves, the confinement of the Uranian rings, and the arcs of rings around Neptune. (author). 37 refs.

27409 (INIS-mf–11400, pp. 159-168) **Planetary rings.** Brahic, A. (Observatoire de Paris, 75 (France)); Sicardy, B. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Despite all new data, the nature of planetary rings is still controversial. We don't know why each planetary ring is so different from the others and we have no idea of the nature of a single particle ring. The large number of structures observed in planetary rings seems to indicate that many different physical mechanisms are simultaneously at work. We are not yet able to include all of them in a single model. Resonances with nearby satellites play an important role, but through complex mechanisms. Appropriate observations and more sophisticated models are needed to improve our understanding of rings and to identify the main physical mechanisms involved. (author). 2 figs., 45 refs.

27410 (INIS-mf–11400, pp. 169-173) **Numerical study of resonances in collisional disks: Application to planetary ring arcs.** Sicardy, B. (Observatoire de Paris, 75 (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Numerical simulations were performed of colliding particles orbiting a massive central planet. The code simulates the 3-dimensional motion of 100 identical spherical particles orbiting a massive central body and suffering inelastic collisions while being perturbed by one or more satellites. This code was used to explore in more detail the dynamics of arc rings, and to explain in particular the recent observations of arc structures around Neptune. Clusters of particles at a satellite's Lagrangian point (L_4 or L_5) are shown to be dispersed by dissipative effects. However, a second satellite can stabilize the system by providing sufficient energy through a Lindblad's resonance m±1:m. Other dynamically equivalent configurations (e.g. only one satellite, but with an eccentric orbit) can also stabilize arc systems, in accord with current analytical models. The roles are examined of collisions at Lindblad and corotation resonances in various cases. Arcs remain at the potential maxima created by the corotations. However, stability requires that the satellites' masses be within a limited range: small satellites cannot provide enough energy while large ones give too much, so the arc may disperse. (author). 8 refs.

27411 (INIS-mf–11400, pp. 175-183) **Physics of instabilities in planetary rings and the prediction of new Uranian satellites.** Fridman, A.M. (AN SSSR, Moscow. Astronomicheskij Sovet); Gorkavij, N.N. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Correlation analysis is used to prove resonance interaction between Uranian rings and new satellites predicted earlier. Instability of circular rings relative to the disturbance with the azimuthal number m=1 is shown; it may be the cause of the ring's eccentricity. This justifies the authors' hypothesis that the formation of eccentric rings of the protodisk around Uranus is due to unknown Uranian satellites. The hypothesis is no longer required of the existence of "shepherd"-satellites in Uranian rings which have not been discovered by Voyager-2. A new accretion instability of the protodisk is described which may have served as generator of the birth of the large-scale structure of Saturn's rings. The discovery of the instability makes it possible to understand the origin of the hierarchic structure of Saturn's rings, since the mechanisms of the formation of narrow ringlets were investigated earlier. (author). 2 figs., 1 tab., 38 refs.

27412 (INIS-mf–11400, pp. 191-196) **Non-rotating origin: conceptual definition. Aplication to the rotation of the Earth.** Souchay, J. (Observatoire de Paris, 75 (France)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The present definition of U.T.1 is a complex one which introduces the old concept of the "Fictitious Mean Sun" which was suggested by Newcomb (1895). The conventional right ascension of the Fictitious Mean Sun brings the basic relationship between Sidereal Time, arising directly from observations, and U.T.1, as is internationally adopted. Unfortunately, understanding of this basic relationship requires some effort from the common user. This is the

reason why B. Guinot (1979) proposed to adopt another point instead of the vernal equinox on the celestial equator, that he called the 'non-rotating origin σ'. This point complies with a clear kinematical concept. Moreover, it should make a new conceptual definition of U.T.1 very easy to understand. The position of σ on the celestial sphere can easily be determined by Eulerian angles PSI and Θ which position the instantaneous axis of rotation of the Earth relatively to an inertial plane of reference. It can also be realized by the way of a quantity 's' depending on the only motion of the instantaneous equator. Formulation and development of 's' are given. (author). 7 figs., 1 tab., 5 refs.

27413 (INIS-mf–11400, pp. 187-190) **Astrophysical interest of the ESA astrometric mission "HIPPARCOS".** Crifo, F. (Observatoire de Paris, Section de Meudon, 92 (France)); Gomez, A.; Turon, C. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The HIPPARCOS satellite should be launched in 1989. It will measure positions, proper motions, and parallaxes of about 110 000 selected stars brighter than 13, with a precision of 2 milliseconds of arc. Accurate positions (up to 1.5 arc second at the date of observation) and magnitudes (up to 0.5mag) have to be known in advance. The star selection has to be optimized with respect to both scientific priorities defined by the ESA Selection Committee, and to technical constraints for satellite operation. The Input Catalogue under construction contains stars selected among the 700 000 ones proposed in 1982 by the world-wide astronomical community. The Input Catalogue Consortium is in charge of making the identifications, providing the necessary data with the required accuracy, and making the selection. A first provisional version has been established in February 1987 and its content is described: (1) "survey" of bright stars, about complete up to a limiting magnitude function of both galactic latitude and spectral type, about 55000 stars; (2) fainter stars from proposed programs: nearby stars; stars with high proper motion; variable stars, in particular Cepheids and RR Lyrae for distance scale calibration; open cluster stars; stars for galactic structure studies; stars in the Magellanic Clouds; stars for reference frame; stars for linking to the extragalactic system; minor planets. A rough estimate of the star distribution versus spectral types and distance is presented. The fulfilment of important astrometric or astrophysical programmes is evaluated. (author). 2 figs., 2 tabs., 21 refs.

27414 (INIS-mf–11400, pp. 197-199) **Generalized method of estimating star corrections from latitude and time observations.** Hefty, J. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Dynamics of the solar system. Proceedings. Vol. 3.* Order Number DE89609828/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Long periods of regular astronomical latitude-longitude measurements at observatories participating in the determination of Earth's rotation parameters are frequently used for estimating corrections of star catalogue mean places and proper motions. The proposed method is an extension and generalization of the usually exploited chain method. Corrections may be estimated of declinations and right ascensions for instruments which determine both latitude and longitude. Additional unknowns - amplitudes of short-periodic terms (e.g. corrections to nutation amplitudes, tidal variations, nearly diurnal polar motion, instrumental parameters and refraction anomalies) may included in total adjustment. The chain need not be closed. (author). 6 refs.

27415 (INIS-mf–11401) **Evolution of galaxies. Proceedings. Vol. 4.** Palous, J. (ed.). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. 479p. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The proceedings contain 87 papers divided into 8 chapters. The chapter Bipolar outflows and star formations contains papers on optical and infrared observations of young bipolar outflow objects and the theory thereof, and on observations of cometary nebulae. The chapter Masers and early stellar evolution discusses molecular masers and star forming regions. The following chapter contains papers on initial mass function and star formation rates in galaxies. The chapter Clusters and star formation contains data on OB associations and open star clusters, their development and observations, CO and H_2 in our galaxy, the four vector model of radio emission and an atlas of the wavelength dependence of ultraviolet extinction in the Galaxy. The most voluminous is the chapter Evolution of galaxies. It contains papers on the theories of the physical and chemodynamic development of galaxies of different types, rotation research and rotation velocities of galaxies and their arms, and on mathematical and laboratory models of morphological development. Chapter seven contains papers dealing with active extragalactic objects, quasars and active galactic nuclei. The last chapter discusses cosmological models, the theory of the inflationary universe, and presents an interpretation of the central void and X-ray background. (M.D.). 299 figs., 48 tabs., 1651 refs.

27416 (INIS-mf–11401, pp. 87-90) **What is the IMF of faint stars?.** Piskunov, A.E. (AN SSSR, Moscow. Astronomicheskij Sovet); Malkov, O.Yu. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A number of effects is studied which can affect the low-mass IMF derived from the local luminosity function. The influence is considered of unresolved binaries, variations in fine structure of mass-luminosity relation, BC-scale, chemical composition, and evolution of brown dwarfs. The mass-luminosity relation is found to be the main factor defining the IMF. As analysis shows different theoretical relations calculated for Pop I composition result in different IMFs (from a power law, to a lognormal one). The presence at faintest magnitudes ($M_v > 20^m$) of a large number of brown dwarfs, slowly evolving with decreasing luminosity, leads to the depletion of the luminosity function for both lognormal and power IMFs. (author). 3 figs., 20 refs.

27417 (INIS-mf–11401, pp. 91-95) **Star formation rates in galaxies.** Mezger, P.G. (Max-Planck-Institut fuer Radioastronomie, Bonn (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The determination is dealt with of global star formation rates (SFRs) from radio free-free and submm/FIR dust emission. Massive, hot and luminous stars interact with the surrounding interstellar matter (ISM) ionizing the gas and heating the dust. O star formation rates (OSFR) in the galactic disk are estimated with observed Lyman continuum photon production rates. Extrapolation to lower mass stars with a constant initial mass function (IMF), however, yields too high total SFRs. Furthermore the lock-up rate, i.e., the rate at which gas transformed into stars is permanently locked up in low mass and dead stars, can not reproduce the present-day mass distribution of the galactic disk. Agreement betweeen Lyc photon production rate and time integrated lockup rate can be reached by introducing bimodal star formation in the galactic disk. This means that induced star formation in main spiral arms produces only massive stars $\geq 3 m_{Sun}$, while spontaneous star formation in the interarm region produces stars in the total mass range $\geq 0.1 m_{Sun}$. Estimates of SFR based on Lyc photon production rates cannot easily be applied to external galaxies because of the difficulty to separate radio synchroton and free-free emission. It is found that similar problems are encountered in separating the emission from warm dust (heated by OB stars) and cold dust (heated by the general interstellar radiation field). The relation between IR luminosity and star formation activity of galaxies is much more complex than previously assumed. (author). 3 figs., 1 tab., 16 refs.

27418 (INIS-mf–11401, pp. 97-99) **Simulation of the bimodal IMF.** Wolf, M. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The hierarchical fragmentation of a molecular cloud is modelled as a random process using the Monte Carlo method. It is proposed that the IMF for star formation is bimodal. The probability of fragmentation in each mode is a function of the initial cloud mass and defined critical mass which can be derived from the surface density and temperature of the cloud. The modelled IMF is compared with the empirically determined function. The best fit was found for critical masses of 0.3 M_{Sun} for low-mass mode and 2.0 M_{Sun} for high-mass mode of star formation. (author). 1 fig., 12 refs.

27419 (INIS-mf–11401, pp. 37-39) **New cometary nebula in Cygnus.** Staude, H.J. (Max-Planck-Institut fuer Astronomie, Heidelberg (Germany, F.R.)); Neckel, T. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A hitherto unknown cometary reflection nebula (α=20^{h}18^{m}3, δ=+37deg00') associated with a dense dust cloud is presented. A bright, compact Herbig-Haro object is embedded in its brightest part. The highly reddened illuminating star of about 3-5 M_{Sun}, located near the apex of the nebula, emits a collimated bipolar flow at high velocity whose blueshifted stream feeds the HH object. The redshifted stream can be traced toward the interior of the dark cloud, where the density exceeds 10^5 cm^{-3}. (author). 6 figs., 8 refs.

27420 (INIS-mf–11401, pp. 43-49) **Molecular masers as tracers of early stellar evolution.** Strelnitskij, V.S. (AN SSSR, Moscow (USSR). Astronomicheskij Sovet). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The contemporary state of the problem of molecular masers observed in regions of active star formation is briefly reviewed. The major landmarks of the history of their discovery, observations, and interpretations are mentioned. OH masers observed in these regions are believed to be a product of disintegration of dense molecular envelopes ("cocoons") surrounding compact HII regions of young OB-stars. They are localized at, typically, $\simeq 10^{17}$ cm from their parent star and have there densities $\simeq 10^6$ cm^{-3}, temperatures $\simeq$100 K, magnetic fields of the order of several mG. At least in some cases they seem to be falling on the star. H_2O (and, as an exception, SiO) masers are connected with still earlier stages of stellar evolution, when a very strong mass loss from the star (up to $\simeq 10^{-3}$ - 10^{-2} M_{Sun}/yr) takes place. H_2O maser emission is produced by gas-dynamical (possibly MHD) interaction between the stellar wind and the surrounding gas. The H_2O sources may be localized much closer to their stars than the OH sources, up to $\simeq 10^{14}$ - $\simeq 10^{15}$ cm, and they indicate much higher densities ($\simeq 10^{11}$ cm^{-3}) and magnetic fields (up to several G), and higher temperatures ($\simeq$100 - 1000 k). They reveal also rather lively kinematics of the circumstellar gas (up to several hundred km/s). CH_3OH 1.3 cm low-gain masers in Orion with their observed dimensions and derived densities and temperatures may be gravitationally unstable and with their position around a pre-Trapezium young star cluster may perferctly be a group of protostars. Much stronger CH_3OH 2.5 cm masers, recently discovered in the direction of many compact HII regions, are closely associated with the OH masers. (author). 3 figs., 47 refs.

27421 (INIS-mf–11401, pp. 51-55) **Non-stationarity of maser radio sources in star formation regions.** Rudnitskij, G.M. (Moskovskij Gosudarstvennyj Univ. (USSR)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Sources of maser radio emission in the water vapor spectral line at 1.35 cm are considered, which are situated in star formation regions, in the vicinity of young stellar objects. The H_2O emission of many maser sources is subject to strong variability; maser activity is thereby of a cyclic character with a period of a few years. On the basis of observational data, it is assumed that the region of maser generation is located in a rotating gas-dust disc around a young stellar object. The author suggests three models explaining the masers, cyclic non-stationarity. (1) The maser's variability is connected with the variable luminosity of the central stellar object, due to non-stationary accretion onto it. (2) In the central cavity of a large circumstellar disc containing the H_2O maser, a smaller disc is located, with its axis tilted to that of the larger disc. The stellar wind jet collimated by the small disc and flowing out from its poles impacts consecutively onto different parts of the large disc's internal surface. This results in the time- and space-variable maser pump. (3) If the maser is unsaturated and amplifies the background continuum radiation, then strong maser flares may be connected with radio flares of the central object (due, e.g., to its magnetic activity) and the corresponding increase of the masers's input intensity. Observational tests for the suggested models are discussed. (author). 3 figs., 34 refs.

27422 (INIS-mf–11401, pp. 57-62) **Early stages of star formation.** Chini, R. (Max-Planck-Institut fuer Radioastronomie, Bonn (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Different aspects of star formation are discussed on the basis of new submm observations. In NGC2024 six cold (T~16 K) and dense (n_H~1E8-1E9 cm^{-3}) so far unknown condensations are found and interpreted as isothermal protostars. The density and temperature structure around massive early type stars which are deeply embedded in dense regions, is discussed by means of thermal emission from dust. A star formation efficiency of 8% is derived from 90 compact HII regions. A comparison with the star formation in normal spiral galaxies and active Markarian objects leads to a new definition of activity. The L/M ratio of active systems is by a factor of 20 higher than the corresponding value in normal spirals and galactic HII regions. (author). 5 figs., 22 refs.

27423 (INIS-mf–11401, pp. 63-66) **High-resolution IRAS infrared maps around HD 97300 and HD 97048.** Wesselius, P.R. (Laboratory for Space Research and Astronomical Institute "Kapteyn", Groningen (Netherlands)); Assendorp, R. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

15 far-infrared sources were found around HD 97300 and HD 97048. 3 of them are not included in the IRAS Point Source Catalogue, for 8 upper limits in the IPSC we have now determined fluxes, and confused sources have been separated better. This indicates that even this nearby region of star formation cannot be studied by just inspecting the IPSC. By including (V)JHK observations the bolometric luminosities of these sources are determined: they range from 0.2 to 20 L_{Sun}. It presumably concerns pre-main-sequence stars ranging in (expected) spectral type from M1 to A7. (author). 1 fig., 1 tab., 11 refs.

27424 (INIS-mf–11401, pp. 67-70) **Infrared emission from cocoon stars in star-forming regions.** Henning, T. (2578450DD); Pfau, W. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

All well-investigated very young and massive stars with optically thick circumstellar shells (BN-like objects) show the silicate feature

close to 9.5 μm. In addition to the only BN object known in the pre-IRAS era to show the 18-μm feature in absorption, our search through the IRAS LRS catalogue revealed two other objects of this type: GL 2591 and S 140-IRS. The IR point source GL 961 which is classified in the IRAS scheme as an object with a red spectrum and no 10-μm band (IRAS class 5n) was shown to be a BN object with a typical self-absorption profile in the 10-μm region and an optical depth in the band centre of about 2.5. In the IRAS Point Source Catalogue we found nine BN-like objects with good flux quality and no confusion by extended sources. The energy distributions of all show a steep increase from 12 μm towards 100 μm. The colour indices defined by $R_{ij}=\log(\lambda_i S_i/\lambda_j S_i)$ (i,j=1: 12 μm; i=2: 25 μm; i=3: 60 μm; i=4: 100 μm) are in the ranges $0.0 \leq R_{12} \leq 1.0$, $0.0 \leq R_{23} \leq 0.5$, and $-0.2 \leq R_{34} \leq 0.2$. R_{12} and R_{34} are similar to the indices derived from IRAS data for IR objects with H_2O masers in the Orion and Cepheus regions. For R_{23} the range occupied by BN-like objects seems to be narrower. Radiative transfer calculations show that the flux below 25 μm can be produced by a compact circumstellar dust shell. The IRAS observations for $\lambda \geq 25$ μm call for a second and more extended cold envelope. (author). 5 figs., 16 refs.

27425 (INIS-mf–11401, pp. 71-73) **Extended near-infrared emission in the Serpens molecular cloud.** Koornneef, J. (Space Telescope Science Inst., Baltimore, MD (USA)); Burrows, C. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Chopped near-infrared maps at 1.25, 1.65 and 2.2 micron in the Serpens dark cloud (S68) centered on IRS3 have been obtained. They show unresolved structure, most likely due to illumination of scattering grains, out to 1' from the center. The combination of high reddening (and 3.07 μm absorption) and asymmetrical optical reflection points to a non-spherical dust distribution typical for bi-polar flow sources. In addition to the maps at J,H,K, which consist of 19 by 47 pixels spaced by 2, (Gunn r and z) CCD images taken at Palomar by Bel Campbell are used. Software is being developed to process these and similar infrared maps using a modified maximum entropy technique. The modifications have been necessary to avoid singularities inherent in the standard maximum entropy algorithm when it is applied to data with zero-volume point-spread functions. (author). 2 figs., 1 tab., 12 refs.

27426 (INIS-mf–11401, pp. 77-86) **Review of the IMF.** Zinnecker, H. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The present-day mass function (PDMF) of field stars in the solar neighborhood is discussed. Major uncertainties in the derivation exist, in particular the luminosity-mass relation and the bolometric corrections. Consequently, it is not clear whether the PDMF turns over at very low masses ($M<0.3$ M_{Sun}), and the slope at the high-mass end ($M>10$ M_{Sun}) is more uncertain than usually assumed. The reality of two features in the PDMF (at $M\sim1.2$ M_{Sun} and $M\sim3$ M_{Sun}) is an open question. Next, the concept of a bimodal IMF is critically examined. Both Guesten and Mezger's (1983) and Larson's (1986) bimodal models may run into problems. If the effects of high-mass stars prevent low-mass stars from forming, the term "biassed IMF" is a better description of the situation than "bimodal IMF". The IMF is probably not universal; reported IMF variations in open clusters and globular clusters are unlikely to be spurious. Finally the physics of the IMF is discussed. The fact that the mass of a star in the making depends on many random-valued (multiplicative) input parameters suggests a stochastic rather than a deterministic approach to the origin of IMF. (author). 6 figs., 72 refs.

27427 (INIS-mf–11401, pp. 3-8) **Optical and near infrared observations of young bipolar outflow objects.** Staude, H.J. (Max-Planck-Institut fuer Astronomie, Heidelberg (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Recent observational results are reviewed, concerning circumstellar disks, the structure of the flow in highly collimated jets, the nature of Herbig-Haro objects and the interrelation between jets, cometary reflection nebulae and bipolar molecular outflows. (author). 10 figs., 36 refs.

27428 (INIS-mf–11401, pp. 9-16) **Observations of bipolar outflows.** Bally, J. (Bell Telephone Labs., Inc., Holmdel, NJ (USA)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Energetic outflows, often collimated into two oppositely directed jets, are frequently found to be associated with new-born stars still buried in their parent molecular clouds. Millimeter wavelength observations of molecular transitions of species such as CO have shown that the cold molecular component of the outflows has velocities up to 60 km s^{-1} with a total mass ranging between 0.01 M_{Sun} for low mass stellar sources to over 100 M_{Sun} for flows having several massive stars at their core. Optical and near infrared observations reveal a hot (over 10^3 K) flow component exhibiting velocities in excess of 300 km s^{-1}. Although some jets associated with low luminosity sources, such as HH-34, exhibit a very high degree of collimation, the structure of most massive outflows is complicated, appearing "bipolar" only in low angular resolution observations. At high resolution, many sources exhibit lumps, oscillations, or flow in more than just two directions. Millimeter-wave as well as some near-infrared and optical observations of this important phase of stellar birth are reviewed. (author). 5 figs., 31 refs.

27429 (INIS-mf–11401, pp. 17-20) **High velocity Herbig Haro objects near Cep A.** Lenzen, R. (Max-Planck-Institut fuer Astronomie, Heidelberg (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

High proper motions of various Herbig Haro objects near Cep A are reported. For a distance of 725 pc tangential velocities are derived of 200 to 250 km/s which have their common origin near the compact HII regions 2 and 3. The resulting kinematic age is 1800±400 years. A weak, pointlike source (I=20.6 mag) is detected at the position of the compact HII region 3a. No further source ($I \leq 23$ mag) could be found in the region of radio continuum emission. However, an elongated feature of diffuse 1 μm emission is observed in line with the northern chain of compact ratio knots. It is concluded that a center of activity near the H_2O-maser positions in HW2 and 3 is responsible for Cep A. It drives the molecular outflow, and also excites the compact radio continuum knots and surrounding HH-objects. The observed total luminosity and the 21 cm radio continuum data are consistent with a B0.5V star or three B1V ZAMS stars. (author). 4 figs., 19 refs.

27430 (INIS-mf–11401, pp. 21-24) **Theory of bipolar flows.** Norman, C.A. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Theoretical models for bipolar flows are discussed with particular emphasis on new observational developments over the last year that have added significant constraints and understanding. Implications of these flows for the cloud environment in which they are embedded are outlined. Associated objects such as masers and Herbig-Haro objects are analysed. It is shown that all reasonable

axisymmetric magnetohydrodynamic flows have some collimation along the symmetry axis. Observational tests of the theories are proposed. A connection between H_2O masers and protoplanetary systems in molecular disks is put forward. (author). 32 refs.

27431 (INIS-mf–11401, pp. 25-27) **On the instability time scale of the outflow associated with the HH 7-11 chain.** Silvestro, G. (Turin Univ. (Italy)); Robberto, M.; Busso, M.; Scaltriti, F.; Persi, P. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The conditions are investigated of the development of Kelvin-Helmoltz instabilities along a collimated wind flow from a low-mass star surrounded by a dense circumstellar disk, which could give rise to condensations with the characteristics of the chain of HH knots in the HH 7-11 system. The flow, using the observational parameters of the source, is clearly unstable. A simple estimate is given of the instability time scale which is in good agreement with the characteristic time of development for outflows from low-mass young stellar objects. (author). 1 fig., 7 refs.

27432 (INIS-mf–11401, pp. 33-35) **Trapezium born in a bipolar nebula.** Neckel, T. (Max-Planck-Institut fuer Astronomie, Heidelberg (Germany, F.R.)); Staude, H.J.; Meisenheimer, K. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Various observations are presented of the bipolar nebula No. 14 from the list of Neckel and Staude (1984): CCD images at 7 different wavelengths, spectroscopy at intermediate resolution between 4800 A and 9500 A, and CCD stellar polarimetry. The central star turns out to be a "Trapezium" consisting of four stars of spectral types between B0.5 and A5. The nebular spectrum is that of a low excited HII region, but in addition it exhibits a strong OI 8446 line excited by Lyman β fluorescence. This requires very high optical depth in Hα (tau$\geq$1000) in the emitting region which has been spatially resolved in NS 14. The stellar polarimetry, combined with the surface polarimetry of Scarrott et al. (1986), indicates that the polarization in the nebula can be explained by pure scattering alone. (author). 7 figs., 8 refs.

27433 (INIS-mf–11401, pp. 29-32) **Observations of young cometary nebula NGC 2261 with the IRAM 30-m telescope.** Bachiller, R. (Centro Astronomico de Yebes, Guadalajara (Spain)); Cernicharo, J.; Martin-Pintado, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The prototype young cometary nebula NGC 2261, around the star R Mon, has been extensively observed with 20" resolution in the J=1-0 line of CO and ^{13}CO with the IRAM 30-m telescope (located on the Pico Veleta, near Granada, Spain). The molecular line maps are compared with optical observations to obtain detailed information on the nature of this cometary nebula as well as on the kinematic structure of the gas. Our observations suggest that cometary nebula NGC 2261 is actually the brightests fan of a bipolar nebula. Furthermore, it appears that the optical nebula is a hollow cone which has been emptied by the action of winds from R Mon, the star located at the tip of the nebula. High velocity CO flows along the cone walls. Toward the position of the star R Mon a molecular maximum is observed which could be due to residual material originated during the collapse process that led to the formation of the star. (author). 3 figs., 14 refs.

27434 (INIS-mf–11401, pp. 129-133) **Observational constraints on the chemical and morphological evolution of the Galaxy.** Strobel, A. (Institute of Astronomy, Torun (Poland)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The time evolution of metallicity within the Galaxy was analyzed from published data for star clusters. The resulting age-metallicity relation seems to have taken 2 independent paths, passing the same age range over 10^{10} years. The lower relationship resembles that of the Magellanic Clouds. Such a picture of the chemical evolution of the galactic matter is consistent with the observed division of the considered sample of open clusters into two groups differing in metallicity and spatial distribution, similar to the division found for globular clusters. The metal-poor open clusters resemble metal-rich globulars. This can suggest that our Galaxy has evolved from a spherical metal-poor configuration represented in the considered sample of star clusters by metal-poor globulars, through a thick disk phase with middle metallicity to a thin metal-rich disk with its representative metal-rich open clusters. The transition between each of the above phases was more or less abrupt in its characteristic chemical and spatial properties. (author). 4 figs., 1 tab., 16 refs.

27435 (INIS-mf–11401, pp. 141-144) **Density profiles of star clusters in the Magellanic Clouds.** Kontizas, M. (Athens Univ. (Greece)); Metaxa, M.; Chrysovergis, M.; Kontizas, E. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The observed dynamical parameters of the Magellanic Clouds (MCs) clusters are derived by star counts. There are many rich globular young disk clusters in the MCs with no counterparts in our galaxy. The old clusters were found statistically less extended with systematically smaller total masses than those of the galactic globulars. So it is worth emphasizing that clusters of all ages (from a stellar evolution point of view) are detected in the MCs with a very large total number of stars and structural parameters characterizing the old halo galactic globulars. The radial density profiles of these stellar systems were used to derive information on their dynamical stage. Some of the clusters indicate mass segregation or post core collapse profiles, giving evidence of a two body relaxation mechanism. Nevertheless some very young clusters show well relaxed profiles with evolutionary ages too short for a two body relaxation mechanism, so that the shape of their profiles is due to their initial relaxation. A number of clusters were found with an unexpected distortion in the outer areas of their density profiles at systematically constant distances to their centres. It is probable that a halo is formed around these clusters giving evidence that the morphology of the MCs may favour the occurrence of such effects. (author). 5 figs., 17 refs.

27436 (INIS-mf–11401, pp. 145-148) **Effect of mass removal on the dynamical evolution of a system of young stars and gas.** Verschueren, W. (Universitaire Instelling Antwerpen (Belgium)); David, M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The star formation process in a molecular cloud core is effectively halted when the newly born stars remove the remaining gas cloud out of the region. Analytical and numerical calculations are presented of the dynamical evolution of a young cluster, which is allowed to deviate from or oscillate around exact Virial Equilibrium (V.E.) during slow and rapid gas removal. It is concluded that deviations from V.E. can influence the final dynamical state of the "naked" cluster significantly. (author). 8 figs., 10 refs.

27437 (INIS-mf–11401, pp. 149-156) **Evolution of open clusters as N-body systems.** Terlevich, E. (Sussex Univ., Brighton (UK). Astronomy Centre). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10.

European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Realistic N-body simulations of open clusters are discussed and compared with main observed cluster features. Most of the models have 1000 bodies with initial masses following a power law mass function of slope α=-2.75. Instantaneous mass loss from stellar evolution; a smooth linearized galactic tidal field and transient shocks by encounters with extended interstellar clouds of different mass-spectrum, density and space concentration are included. Close approaches between particles are treated by a two-body regularization technique that allows to follow binary evolution in detail. Good agreement is found between the distribution of lifetime for galactic clusters and the life of the models. It is found that the combined action of evolutionary mass loss and binaries (for 1000 star clusters with a realistic mass function) is enough to arrest the core collapse. Tidal heating shapes the halo of the cluster and produces a distinctive density and velocity distribution. Encounters with standard clouds do not alter the life-time of the clusters; while giant molecular clouds produce a catastrophic disruption. Mass segregation and preferential escape of light stars can account for the depletion of low luminosity stars in the better observed central region of clusters. Work on the primordial stages of evolution of clusters during star formation is reviewed, and linked to work on N-body clusters. (author). 65 refs.

27438 (INIS-mf–11401, pp. 189-192) **New method of reduction of dimensionality in discriminant analysis: application to the membership problem in open clusters.** Cabrera-Cano, J. (Dpto. de Optica, Facultad de Fisicas, Universidad de Sevilla (Spain)); Munoz, J.; Alfaro, E.J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A method of reducing dimensionality in discriminant analysis was specially designed for the separation of two populations and it is only based on the heterocedasticity of both groups. It is therefore of interest in the case of the zero mean difference vector. Two examples of application are shown concerning the membership problem in open clusters from uvby and Hβ photometry and the separation of globular clusters into Oosterhoff's groups. (author). 4 tabs., 5 refs.

27439 (INIS-mf–11401, pp. 193-197) **Age of globular clusters derived from BVRI CCD photometry.** Alcaino, G. (Instituto Isaac Newton, Ministerio de Educacion de Chile, Santiago (Chile)); Liller, W. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The modern generation of electronic detectors, such as the CCD, have made improved photometry possible, especially at magnitudes near photographic plate limits and at wavelengths extending to the near infrared. Vigorous efforts should now be made to extend measurements to longer wavelengths since VandenBerg and Bell (1985) have recently calculated BVRI synthetic isochrones. Consequently, a programme has been embarked on of CCD BVRI photometry for determining the ages of globular clusters. From BVRI CCD frames obtained with the 1.54 Danish telescope at ESO-La Silla, at this moment the reductions have been completed of the following 5 globular clusters: NGC 104 (47 Tuc), NGC 2298, NGC 5139 (ω Cen), NGC 6121 (M4), and NGC 6362. For these clusters ages all close to 17×10^9y were derived, providing strong evidence that the globular cluster system is coeval and that the epoch of the galactic contraction was short. (author). 4 figs., 5 tabs., 20 refs.

27440 (INIS-mf–11401, pp. 101-110) **Starbursts and galaxy evolution.** Scalo, J.M. (Texas Univ., Austin (USA)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A survey is presented of observational evidence related to current and past starbursts in galaxies with a variety of properties - blue compact dwarfs, nuclear and extranuclear disk galaxy starbursts, interacting and barred galaxies, large clumpy irregulars, normal ellipticals, galaxies at moderate redshift, and normal isolated spirals and irregulars. After a review of general results inferred from colors, far infrared emission, and multiwavelength studies, a number of constraints derived from studies of samples of interacting galaxies are discussed. It is emphasized that the majority of starbursts may not involve interactions or bars, and a significant fraction are extranuclear. It is suggested that the statistics and varieties of starburst galaxies, the range in current star formation rates per unit area or mass at a given morphological type, the mean and dispersion in gas depletion timescales and recent-to-past average star formation rate ratios, and the existence of red yet HI-rich spiral galaxies can be understood if sporadic star formation is a major mode of evolution in "normal" galaxies. Direct support for this suggestion is provided by three independent estimates of the star formation history of the Milky Way. (author). 6 figs., 1 tab., 110 refs.

27441 (INIS-mf–11401, pp. 111-114) **IMF of starburst clusters.** Melnick, J. (European Southern Observatory, Garching (Germany, F.R.)); Terlevich, R. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The main sequence mass function of violent star formation regions was investigated by observing extremely young star bursting dwarf galaxies (HII galaxies). The effective temperatures of the total ionizing radiation in these systems decrease more steeply with abundance than expected from metallicity dependent changes in the internal structure of the stars and from decreased cooling in the nebulae but can be explained if the mass function varies consistently with chemical composition. (author). 4 figs., 22 refs.

27442 (INIS-mf–11401, pp. 115-118) **Star formation rate in central parts of spiral galaxies.** Sil'chenko, O.K. (Moskovskij Gosudarstvennyj Univ. (USSR). Gosudarstvennyj Astronomicheskij Inst. "GAISh"). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The evolutionary synthesis method is applied to calculate MgI+MgHλ5150 and TiOλ7150 absorption features of integrated spectra and integrated UBV colours of a stellar system. These calculations are used to investigate star formation rate in nuclei of some spiral galaxies. The (I_{Mg},B-V) diagram is shown to be a good discriminator between metallicity and star formation effects. Star formation rates, metallicities and initial mass function slopes are obtained for the nuclei of 8 spiral galaxies. Star formation rates in nuclei correlate with rotation velocities of galaxies. Dynamical friction of gas clouds system in a galactic stellar disk is the possible cause of that correlation. (author). 4 figs., 2 tabs., 19 refs.

27443 (INIS-mf–11401, pp. 121-127) **Distribution of OB associations and open star clusters.** Lynga, G. (Lund Observatory (Sweden)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Data were processed and evaluated obtained from an extensive catalogue of photometric and spectroscopic observations of associations and open star clusters. They are the ideal tracers of the present galactic structure and its recent evolution and also allow the determination of luminosity and mass functions. Their formation and destruction will provide information on conditions prevailing in the galactic disk. Associations and star clusters are classified by types; their spatial distribution in the galaxy is studied as is the metallicity

gradient and the age gradient for open clusters. The distribution of clusters and of their radial velocities shows the effects of disk heating. Present cluster formation rate is much higher inside complexes than outside. A brief survey is presented of data on Magellanic Cloud clusters and M31 and M33. (M.D.). 7 figs., 1 tab., 42 refs.

27444 (INIS-mf–11401, pp. 177-180) **Early type stars segregation in very young clusters.** Kontizas, E. (Astronomical Institute, National Observatory of Athens (Greece)); Xiradaki, E.; Kontizas, M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The very young LMC clusters SL666, NGC2098 and NGC2100 were found to exhibit a variation of spectral types with distance from the cluster centre. From spectral classification of their bright members it is found that the early type stars are accumulated in the inner region of the cluster whereas the late type ones are found in the outer areas. Star counts on photographic plates with different exposure times have shown that the bright stars are segregated in the central regions of the clusters. Both observational results from spectral classification and star counts give evidence that the most massive early type stars are located in the inner parts of the clusters. This allows to suggest that the observed mass segregation is not due to the relaxation mechanism of the clusters but rather due to a delayed star formation towards the centre of the clusters. (author). 2 figs., 13 refs.

27445 (INIS-mf–11401, pp. 181-184) **M39: a photometric membership test for corona stars selected by proper motions.** Zelwanowa, E.I. (Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Astrophysik). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A photometric membership test was carried out for stars in the region of the open cluster M 39 (= NGC 7092 = OCL 211 = C 2130 + 482) selected by Artyukhina, Kalinina from proper motions to be probable members of the cluster corona. Using UBV observations of 28 brighter (BD) stars and additional photometric data from other available sources out of the 117 probable members in the region outside of the cluster core, membership could be confirmed for 37; 22 of the stars do not belong to the cluster. The results confirm the existence of the cluster corona statistically found by Artyukhina. The distribution of the confirmed members over the investigated area of about 5deg diameter indicates that the corona of this poor cluster is much larger than 75', as suggested by the statistical investigation. (author). 2 figs., 14 refs.

27446 (INIS-mf–11401, pp. 157-159) **Dynamical evolution of star clusters and the possible disruption of globular clusters in M87 by massive black holes from a dark corona.** Wielen, R. (Astronomisches Rechen-Institut, Heidelberg (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The dynamical evolution of star clusters is discussed. The possible disruption of globular clusters by massive black holes, which have been proposed as the major constituents of dark galactic coronae, is investigated. The globular clusters in the elliptical galaxy M87 are discussed. The proposed massive black holes could be responsible for the observationally indicated depletion of the globular cluster system in the inner parts of M87 with respect to the stellar light distribution of this galaxy. (author). 1 tab., 9 res.

27447 (INIS-mf–11401, pp. 161-164) **Secondary star formation in IC 1396.** Kun, M. (Konkoly Observatory, Budapest (Hungary)); Balazs, L.G. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The possible formation of a new stellar generation may be seen in the bright rimmed dark clouds that surround the giant HII region IC 1396. A well-defined ring of IRAS point sources is projected near the ionization front indicated by the bright rims. It is suggested that some of these sources are young stellar objects and the majority represents density enhancements in the shocked neutral gas layer preceding the ionization front which might eventually become stars. (author). 3 figs., 2 tabs., 20 refs.

27448 (INIS-mf–11401, pp. 165-169) **Photometry and spectroscopy of the young stellar cluster NGC 2244.** Hensberge, H. (Huygens Lab., Leiden (Netherlands)); Dek, A.W.; Verschueren, W.; Loore de, C. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The final dynamical evolution of a cluster is strongly influenced by the removal of the parent gas cloud after the star formation process in the region has stopped. The knowledge of a number of essential physical parameters of young open clusters and associations, such as the mass and velocity distribution of the stars and the gas as a function of position in the cluster, is of vital importance for the construction of detailed dynamical models of these regions. In this context, MGC 2244 has been selected for an observational study. First results, are presented, including progress made on membership determination and detection of Hα emission B-type stars. (author). 3 figs., 8 refs.

27449 (INIS-mf–11401, pp. 171-175) **Spatial distribution of the young populations of various age groups in the Sagittarius-Carina arm.** Avedisova, V.S. (AN SSSR, Moscow. Astronomicheskij Sovet). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The spatial distribution is investigated of the young objects of various are groups - HII regions and open clusters - in the Sagittarius-Carina arm (SC arm) at l=280deg-25deg. Both transverse and longitudinal age gradients were found in the arm. Two giant star formation complexes with the size of about 1 kpc at l=285deg-300deg and at l=340deg-20deg were found. Each of them contains several giant HII regions, a number of giant molecular clouds (GMCs) and some extremely young clusters. Between these complexes an elder one was found of the same size. This complex contains 24 (3-6)x10^7 years old open clusters and a small number of faint HII regions. Assuming that it is a remnant of a giant star formation complex the upper limit of lifetimes for such complexes and GMCs is (3-6)x10^7 years. Estimations are made of spiral pattern parameters. The value of the pitch angle is 21deg±3deg. The value of spiral pattern velocity, ~26.8±2.2 km/s.kpc, leads to the conclusion that the Sun is near the corrotation radius of the Galaxy. The star formation efficiency in these complexes is discussed. (author). 3 figs., 2 tabs., 22 refs.

27450 (INIS-mf–11401, pp. 135-139) **System of complexes of open star clusters.** Barkhatova, K.A. (Ural'skij Gosudarstvennyj Univ., Sverdlovsk (USSR)); Kutuzov, S.A.; Ossipkov, L.P.; Nezhinskij, E.M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Data on 11 open star cluster complexes are presented. From the analysis of the data a conclusion is derived as to the probable existence of a rotating system of star complexes. (author). 1 fig., 3 tabs., 17 refs.

27451 (INIS-mf–11401, pp. 185-187) **Catalogue of eclipsing binaries in fields of open clusters.** Clausen, J.V. (Copenhagen Univ. (Denmark)); Gimenez, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A computer-generated catalogue is presented of optical coincidences of eclipsing binary systems with galactic clusters. The catalogue is based on tape versions of the Lund Catalogue of Open Clusters, a Finding List for Observers of Interacting Binary Stars, 5th edition and the General Catalogue of Variable Stars, 3th edition. All binaries within 5 cluster radii (or within 20 arcmin) were included. A general, detailed discussion on membership is presently taking place, and new candidates to be included in the study of eclipsing binaries in galactic clusters are selected. (author). 9 refs.

27452 (INIS-mf–11401, pp. 283-288) **Fine structure of galactic spiral arms.** Feitzinger, J.V. (Bochum Univ. (Germany, F.R.). Astronomisches Inst.); Spicker, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

New galactic radial velocity fields are presented. Turbulence is incorporated via the stochastic star formation processes. (author). 5 figs., 16 refs.

27453 (INIS-mf–11401, pp. 289-292) **Large scale galactic shocks in barred galaxies.** Lindblad, P.O. (Stockholm Observatory (Sweden)); Joersaeter, S. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Detectors like the IPCS and CCD make it possible to study strong velocity gradients at high spatial resolution even in the presence of large intensity gradients. Strong velocity gradients indicating galactic shocks were found in NGC 1365 at the inner side of a spiral arm, at the leading edges of the bar, and in the nuclear region. It is suggested that shocks in the nuclear region are caused by rapid twisting of closed orbits at the position of the ILR. (author). 4 figs., 7 refs.

27454 (INIS-mf–11401, pp. 293-299) **Methods of studying self-consistent models of flat systems.** Petrou, M. (Oxford Univ. (UK). Dept. of Theoretical Physics). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

From the study of orbits and models of galaxies in recent years, it has become clear that Jeans' theorem is not adequate for building self-consistent models of real galaxies. The non-classical integrals play an important role in the dynamics of the system and their non-global nature must be taken into consideration. A new method is reported for constructing self-consistent models of galaxies, where the distribution function is a function of the actions and the stochastic orbits are properly taken into account. It was applied to the case of constructing a self-consistent model of a non-rotating bar, and the way by which this method can be used to construct any sort of disk model is discussed. (author). 5 figs., 6 refs.

27455 (INIS-mf–11401, pp. 271-273) **Model of galactic evolution.** Ferrini, F. (Instituto di Astronomia, Pisa (Italy)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A review is presented of a series of works on the galactic evolution putting emphasis on the foundations of the models instead of on their detailed structure. Examples are given of how the mathematical formulation is produced from the physical input, how it can be modified as physics is enriched, and what kind of results can be obtained. (author). 5 figs., 11 refs.

27456 (INIS-mf–11401, pp. 275-277) **Chemodynamical evolution of galaxies.** Burkert, A. (Muenchen Univ. (Germany, F.R.)); Hensler, G. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

One-dimensional calculations of the evolution of protogalaxies are presented. The stellar component, three phases of the interstellar medium and their interactions are treated in detail, taking into account stellar evolution, stellar mass loss, nucleosynthesis, heating and cooling of the gas, and condensation and evaporation of clouds. In agreement with observations the models yield mass-dependent results of (1) supernova-driven galactic mass loss that will form a hot corona around ellipticals and accounts for an abrupt termination of the evolution of dE's, (2) metal-enrichment, explaining the L-Z-relation, (3) low metallicity gradients in dwarf galaxies. (author). 3 figs., 1 tab., 15 refs.

27457 (INIS-mf–11401, pp. 279-281) **Chemical evolution of the Galaxy and comets.** Vanysek, V. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The possible influence of comets on the growth of heavy elements abundance suggested several years ago by Tinsley and Cameron is shortly reviewed. Such an effect would be significant if the formation of comets produced cometary material equivalent to 0.01-0.02 M_{Sun} per one solar mass. In view of the current hypothesis of the formation and structure of cometary nuclei, the role of comets should be considered as being one of the possible moderators of the Z value variation during the chemical evolution of our Galaxy. (author). 1 fig., 10 refs.

27458 (INIS-mf–11401, pp. 249-254) **Internal evolution of spiral galaxies.** Sellwood, J.A. (Manchester Univ. (UK). Dept of Astronomy). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

It is argued that spiral patterns in galaxies generally are transient features which will decay away in a few dynamical times, only to be replaced by other similarly short-lived waves. The evidence for this point of view is presented and the current state of the theory is discussed. A major consequence of such behavior is that disc stars are scattered into gradually more eccentric orbits by successive spiral waves. This has two further implications: (a) the velocity dispersion of stellar populations will increase with their age and (b) persistent spiral structure demands a gas component in the disc that can dissipate some of the random motion energy. That the theory offers such a natural explanation for these two well established aspects of galactic structure is cited as indirect evidence in its favour. (author). 2 figs., 28 refs.

27459 (INIS-mf–11401, pp. 255-262) **Morphology and evolution of spiral structure.** Bertin, G. (Scuola Normale Superiore, Pisa (Italy)); Lin, C.C. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Quasi Stationary Spiral Structure is the natural interpretation for grand design spiral galaxies. The best theoretical tool to describe QSSS morphologies is the study of spiral modes. Modal studies are

characterized by two distinct stages. At the dynamical level, one wishes to compute spiral modes efficiently on a variety of equilibrium models, and to master the relation between the properties of the basic states and the properties of the relevant spiral modes. At the astrophysical level, realistic basic states are identified by discussing the processes of evolution and self-regulation; in particular, some basic states are identified consistent with QSSS grand designs and others where more flocculent spiral structure is expected to occur. For this second stage it is crucial to have a proper interpretation of the results obtained from one-component models in view of the multi-component astrophysical systems to be described (which include stars, Population I objects, and cold gas). Following this outline, under the guidance of a simple analytic (asymptotic) theory, a very large set of galaxy models was studied numerically. This is essentially a three dimensional survey within a flexible class of models, where one parameter measures the amount of participating disk mass, a second parameter determines the hotness of the disk, and the third is a scale length which combines properties of the size of the nuclear bulge and the distribution of the cold gas component. All the essential morphological types found in the Hubble diagram have been reproduced; in particular, parameter regimes are identified for SA and SB galaxies and specifically for SBO, SB-r and SB-s objects. Distinction is made between systems where gas is expected to play an active role or a passive role. (author). 2 figs., 49 refs.

27460 (INIS-mf–11401, pp. 263-265) **Galactic radial gradient of velocity dispersion.** Oblak, E. (CNRS, Observatoire de Besancon (France)); Mayor, M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The model for deducing the local value of galactocentric gradient of the velocity dispersion is based on the local distribution of orbital eccentricity e, mean orbital radius ω-bar and the velocity perpendicular to the galactic plane. This is applied to samples of the Gliese's catalogue delimited by stars of F, G and K spectral types. For the galactic radial gradient of velocity dispersion the value of -0.2 kp/c is obtained, which is compatible with the Toomre's local stability criterion. (author). 4 figs., 2 tabs., 12 refs.

27461 (INIS-mf–11401, pp. 267-270) **Vertex deviation in the galactic plane.** Sanz Subirana, J. (Departament de Matematiques, Universitat Politecnica de Catalunya (Spain)); Catala Poch, M.A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Vertex deviation in the galactic plane is not compatible with the Oort-lindbalad theory about galactic rotation (stationary system with cylindrical symmetry). However, it is shown that it can be obtained in a stellar system model that verifies the Chandrasekhar postulates in a non-stationary state, axial symmetry, non-cylindrical, and with an equatorial plane of symmetry. (author). 4 figs., 1 tab., 9 refs.

27462 (INIS-mf–11401, pp. 225-229) **4V (four vectors) model of the radio emission.** Milogradov-Turin, J. (Belgrade Univ. (Yugoslavia)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The model has 4 components: the extragalactic background, the radiation from the galactic disc and 2 components related to a spur. It fits observations while the hypothetical radio halo does not. (author). 4 figs., 21 refs.

27463 (INIS-mf–11401, pp. 231-235) **High resolution study of diffuse interstellar bands.** Westerlund, B.E. (Uppsala Ionospheric Observatory (Sweden)); Krelowski, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

High resolution (0.05 A) spectra are used for the determination of the profiles of the diffuse interstellar bands 5780 and 5797 originating in single clouds. It is shown that some of the clouds may contain agents of certain diffuse bands whereas others may not. The profiles of diffuse bands observed in distant stars contain contributions from several clouds, differing in optical properties, which share the Doppler displacements observed in interstellar sodium lines. The Doppler splitting inside the diffuse bands' profiles is, however, efficiently veiled because of the large intrinsic widths of the bands under consideration. (author). 7 figs., 15 res.

27464 (INIS-mf–11401, pp. 237-239) **Solving asymmetries in the HVC's distribution.** Bajaja, E. (Instituto Argentino de Radioastronomia, Buenos Aires); Morras, R.; Poeppel, W. G.L. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A large sample of high velocity HI detections was collected from several surveys of HVCs. All detections of HI that could be associated with a known object were subtracted. The main asymmetries in the velocity-position diagrams, shown by the very high velocity components (VHVCs), were apparently reproduced with a kinematic model which, in addition, could explain other peculiarities, of the HVCs distribution. The parameters of this model indicate that the VHCVs might be at distances of the order of the size of the Local Group of Galaxies. (author). 3 figs., 10 refs.

27465 (INIS-mf–11401, pp. 241-242) **^{13}CO survey of the galactic plane from l=38deg to l=67.5deg: clouds and arms.** Jacq, T. (Observatoire de Bordeaux, 33 - Floirac (France)); Despois, D.; Baudry, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The galactic plane was sampled at a 5', spacing between l=38deg and l=67.5deg in the J=1-0 line of ^{13}CO with the 2.5 m telescope of the Bordeaux Observatory. An automatic analysis of the data gives 181 clouds with masses ranging from a few solar masses to a few 10^5 M_{Sun}. At least two spirals can be fitted to the data. (author). 2 figs., 7 refs.

27466 (INIS-mf–11401, pp. 201-207) **Local interstellar medium.** Blitz, L. (Maryland Univ., College Park (USA)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The structure of the local interstellar medium is reviewed with emphasis on the new observations of the cold neutral component. The properties of the high latitude molecular clouds are discussed as well as their relationship to the "infrared cirrus" and atomic gas. The molecular clouds are shown to lie preferentially along the loops and filaments of local HI gas, but a detailed examination shows the CO and HI peaks are offset from one another. An expansion velocity of 7 km s^{-1} is derived for one of the shells suggesting an expansion energy of $\sim 8 \times 10^{47}$ ergs which is somewhat smaller than that expected for a supernova explosion. If the pressure in the clumps of the high latitude clouds is in equilibrium with the surrounding gas, the pressure in the shells is 10^4-10^5 cm^{-3} K, an order of magnitude higher than what is generally argued to exist in the interstellar medium. (author). 4 figs., 1 tab., 27 refs.

27467 (INIS-mf–11401, pp. 219-221) **Spiral structure and star formation.** Elmegreen, B.G. (IBM Watson Research Center, Yorktown Heights, NY (USA)). Ceskoslovenska Akademie Ved,

Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The formation of giant regions of star formation by gravitational instabilities in spiral arms is discussed. The importance of the spiral arms strength for triggering new star formation is emphasized. (author). 1 fig., 17 refs.

27468 (INIS-mf–11401, pp. 223-224) **Nebular photometry on the plates of SERC(J) survey.** Polechova, P. (Observatory and Planetarium of Prague (Czechoslovakia)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

NEBULAE/photometry; DATA PROCESSING; H2 REGIONS; NEBULAE; PHOTOMETRY

27469 (INIS-mf–11401, pp. 209-216) **Local kinematics of young objects.** Palous, J. (Ceskoslovenska Akademie Ved, Prague. Astronomicky Ustav). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The radial velocities of star forming regions and young open star clusters from our galaxy are statistically investigated. The cubic, plane approximation of a general velocity field is applied and it is concluded that with all objects from the sample, which reside within 10 kpc from the Sun, the velocity field is close to circular. However, the young objects from the local spiral arm deviate. This deviation is different from that caused by the linear density wave or by the collisionless expansion from a small region. It is proposed that the velocities of young local objects may be interpreted as a consequence of a large scale multi-supernova remnant. (author). 8 figs., 2 tabs., 25 refs.

27470 (INIS-mf–11401, pp. 243-245) **Atlas of the wavelength dependence of UV extinction in the Galaxy: a presentation.** Aiello, S. (Florence Univ. (Italy)); Perinotto, M.; Barsella, B.; Chlewicki, G.; Mayo Greenberg, J.; Patriarchi, P. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A short description is given of the Atlas of UV extinction which will be published in the Astronomy and Astrophysics Suppl. Series. The Atlas presents a collection of 115 extinction curves derived from low dispersion IUE spectra retrieved from the VILSPA Data Bank. (author). 2 figs., 3 tabs., 8 refs.

27471 (INIS-mf–11401, pp. 307-309) **Investigation of the galactic rotation from the 21 cm line.** Petrovskaya, I.V. (Leningradskij Gosudarstvennyj Univ. (USSR)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The maximum likelihood method is used for a study of galactic rotation which utilizes the whole 21 cm line profile. The rotation curve is obtained in the region of R=0.4 to 2.3 R_0. No evidence has been found for fall-off below a flat rotation curve. (author). 3 figs., 13 refs.

27472 (INIS-mf–11401, pp. 311-315) **Flat disk models - rotation curves and a new model for Milky Way.** Akyol, M.U. (Selcuk University Faculty of Education, Konya (Turkey)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Flat disk models for galaxies are studied on the basis of oscillations of distributed mass around equilibrium configurations. Several kinds of galactic orbits are possible with peculiar rotation curves. Supersonic and very high velocities seem likely in the central region. Conventional rotation curve breaks into two: inner to the Solar circle and spiral arms. A new model for our galaxy is proposed. (author). 9 figs., 24 refs.

27473 (INIS-mf–11401, pp. 317-318) **Dynamical constants for our galaxy.** Ninkovic, S. (Astronomska Opservatorija, Belgrade (Yugoslavia)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The following system of galactic dynamical constants is proposed: local escape velocity $u_e=(520\pm30)$ km s^{-1}, local circular velocity $u=(230\pm30)$ km s^{-1}, local angular velocity of rotation $\omega=(25\pm5)$ km $s^{-1}kpc^{-1}$, local circular frequency of planar oscillations $k_\rho=(40\pm10)$ km $s^{-1}kpc^{-1}$, local circular frequency of vertical oscillations $k_z=(70\pm20)$ km $s^{-1}kpc^{-1}$. The value of (9 ± 1) kpc is assumed for the galactocentric distance of the Sun. The latter three values yield $(0.09\pm0.03)M_{Sun}$ pc^{-3} for local matter density, a value very close to density obtained by use of statistical methods. On the basis of the proposed value it is concluded that dark matter should be present in the form of a large, rarefied, massive, spherical corona. (author). 1 tab., 17 refs.

27474 (INIS-mf–11401, pp. 319-322) **New method to determine the sense of rotation of spiral arms in the barred galaxies.** Afansiev, V.L. (AN SSSR, Nizhnij Arkhyz. Spetsial'naya Astrofizicheskaya Observatoriya); Fridman, A.M.; Pasha, I.I. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Galactic bars are thicker than inner parts of gas disks. Therefore, gas flows into the rear of bars, relative to the direction of disc rotation. This idea, based on the equilibrium condition for galactic rotating subsystems, is used to interpret forbidden line emission in bar regions where gas inflow is supersonic. The suggested interpretation of the phenomenon of different velocity fields in the line of different excitation first discovered in the Seyfert galaxy Mkn 744 = NGC 3786 is now checked in the case of another Seyfert NGC 1068. The applicability is controlled from the inferences concerning the sense of rotation of spiral arms in the galaxies. In both cases these agree with earlier results obtained from independent methods: the arms in NGC 1068 are trailing, while in NGC 3786 they are leading. One of manifestations of the shock back along the front side of bars is the occurrence of straight dust lanes along the front side. Applications of the method to other observational problems are discussed. (author). 3 figs., 13 refs.

27475 (INIS-mf–11401, pp. 391-393) **Shock acceleration of secondary particles in active galactic nuclei.** Klemens, Y. (Max-Planck-Institut fuer Radioastronomie, Bonn (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A model is proposed explaining the variations in the size of sharp spectral cutoffs at IR-V frequencies and in X-ray intensity of active galactic nuclei. The model assumes a jet of ultrasonic plasma streaming through the broad line region of the active galactic nuclei. Collisionless shocks are produced within the jets that accelerate the relativistic population of electrons and protons. The accelerated protons interact with dense clouds and the intercloud medium of the broad line region thus forming secondary electrons and positrons

through pion creation process. The model is illustrated with figures and calculations. (L.O.). 5 figs., 6 refs.

27476 (INIS-mf–11401, pp. 395-398) **Star formation and structure of the NGC 1275 galaxy circumnuclear region.** Pronik, I. (AN SSSR, Crimea. Krymskaya Astrofizicheskaya Observatoriya); Metik, L. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The Seyfert galaxy NGC 1275 circumnuclear region was investigated using spectral and color photometry which allowed to reveal the region of active star formation near details, located 3" North-West and 7" North-East from the NGC 1275 galaxy nucleus. The mass of these HII zones is about 10^6-10^7 M_{Sun}. (author). 5 figs., 7 refs.

27477 (INIS-mf–11401, pp. 379-381) **Observational consequences of precessing relativistic jets in extragalactic radio sources.** Meurs, E.J.A. (European Southern Observatory, Garching (Germany, F.R.)); Roos, N. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Jets of extragalactic radio sources in many cases show signs of precessional motion. This may arise when two massive compact objects are close to each other within a galaxy nucleus. The observed radio brightness distributions are modelled by slowly precessing jets, often relativistic. Interesting illustrations of their behavior are offered by the frequency of occurrence of one-sided jets and by an explanation of the "preferential avoidance" effect. There may be some evidence for a binary massive black hole in the nearest galaxy nucleus, the Galactic Centre. (author). 6 figs., 17 refs.

27478 (INIS-mf–11401, pp. 383-386) **Radio studies of Virgo Cluster spirals at 10.7 GHz.** Urbanik, M. (Uniwersytet Jagiellonski, Krakow (Poland). Obserwatorium Astronomiczne); Klein, U.; Graeve, R. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The 10.7 GHz observations of four Virgo Cluster spirals made with the 100 m Max-Planck-Institut fuer Radioastronomie radio telescope are examined for possible effects of the cluster environment. Their radio structure parameters were compared to those known from observations of nearby field spirals. A search for an anomalous composition of the 10.7 GHz radiation and for a general emission deficiency of these spirals relative to field galaxies was also made. (author). 2 figs., 18 refs.

27479 (INIS-mf–11401, pp. 387-390) **Accretion disks in soft potential wells.** Duschl, W.J. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The softer a potential is, the closer the corresponding Keplerian rotation is to a rigid rotation law. Because of the small radial coupling in such a situation the radial mass flow due to viscosity in an α-accretion disk is very inefficient. A model is presented here in which the mass of an accretion disk ina soft potential well changes this potential in a sense that an efficient mass flow in radial direction becomes possible, thus making the formation of a central mass condensation possible. This mechanism is of interest in the context of galactic central regions since it is capable of explaining the existence of central masses such as are observed in the cores of normal galaxies; it might also be of relevance for explaining the activity in AGNs. (author). 10 refs.

27480 (INIS-mf–11401, pp. 371-374) **Extended emission line region of Mrk 3 and its interrelation with the active nucleus.** Wagner, S.J. (Landessternwarte Heidelberg, Koenigstuhl (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Mrk 3 is an early-type galaxy, probably a transition case between E and SO. Analysis of the isophotes clearly shows a disk component along the major axis. A large extended emission line region (EELR) was found. It is confined to a disk along the minor axis, perpendicular to the stellar disk component. The radio-jet of Mrk 3 is almost perpendicular to the stellar disk and has a small inclination only against the EELR. The ionization mechanism and dynamical state of the EELR was studied from several long slit spectrograms both along and perpendicular to the EELR extension. Both [OIII]/Hβ and [NII]/Hα clearly indicate that the spectrum of the NLR deviates from HII regions. The line ratios are similar to the values found for the NLR of Mrk 3, indicating that the power law source is responsible for ionization to several Kpc. Off-centre spectrograms indicate that kinematics is governed by rotation and an additional inflow motion. This accretion flow could have velocities as large as 20 km/sec. It is speculated that the unusually broad and asymmetric lines of the NLR indicate a close interaction with the velocity pattern of the EELR. (author). 9 figs., 7 refs.

27481 (INIS-mf–11401, pp. 375-378) **VLBI observations of elliptical galaxies.** Feretti, L. (Bologna Univ. (Italy)); Giovannini, G.; Comoretto, G. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The first results are presented of a statistical study on the milliarcsec structure in a complete sample of active radio galaxies. Many papers have been published on properties of VLBI cores in quasars, but no similar studies have been carried out for galaxies. A 2-stage strategy was adopted for the observations. As the first step, a photograph was taken of all the selected sources, in order to have an indication on the size and flux of the milliarcsecond component. These first observations are presented here. (author). 1 fig., 1 tab.

27482 (INIS-mf–11401, pp. 345-348) **Structure of galaxies and star formation workshop summary.** Norman, C.A. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A summary and critique is presented of the work discussed at the conference on the following major topics that were presented at the rate of one per day: Bipolar Flows and their associated Masers and Herbig-Haro Objects; the Initial Mass Function, the Large Scale Gas and Kinematical Distribution; Star Clusters; and Star Formation and Starbursts. (author). 1 fig.

27483 (INIS-mf–11401, pp. 351-358) **Active extragalactic objects.** Fosbury, R.A.E. (European Southern Observatory, Garching (Germany, F.R.)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Some aspects are reviewed of recent studies of active galactic nuclei (AGN) and their environments, proceeding from the hypothesis that a single AGN phenomenon includes the plethora of object classes whose acronyms pervade the literature. Particular attention

is given to the mechanisms of interaction between the central engine and its environment, both with regard to the ways in which the observed radiation is produced on a range of spatial scales and to the ways in which the activity is related to outside influences. (author). 3 figs., 1 tab., 48 refs.

27484 (INIS-mf–11401, pp. 359-365) **Physics of outflows from active galactic nuclei.** Ferrari, A. (Turin Univ. (Italy)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Outflows participating in defining the various types of morphologies and features observed in Active Galactic Nuclei (AGN) are discussed. Possible interpretations are suggested of structures observed at radio frequencies (non-thermal continuum radiation) and optical frequencies (continuum and emission line radiation) in terms of results from numerical simulations of outflow propagation and their analytical physical explanation. The conclusion is that we have already reached a good qualitative knowledge of the dynamic effects which shape AGN's structures; the quantitative estimate of their relative importance and conditions of occurrence still awaits a better study of the nonlinear processes in astrophysical conditions and more observational data to determine the values of the physical parameters. (author). 2 figs., 22 refs.

27485 (INIS-mf–11401, pp. 367-370) **[OIII]-line emission associated with radio structures in Seyfert galaxies.** Meurs, E.J.A. (Cambridge Univ. (UK). Inst. of Astronomy); Whittle, M.; Ward, M.J.; Unger, S.W.; Axon, D.J.; Pedlar, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Seyfert galaxies with linear nuclear radio structures were studied with long-slit spectroscopy. Very extended, narrow [OIII] emission is detected in several of the objects, highly elongated along the radio source axis. This Extended Narrow Line Region would be consistent with interstellar gas that is photoionized by collimated energetic radiation from the nucleus. Within the Narrow Line Region detailed correspondences between [OIII] emission features and individual radio components were found in a number of Seyfert galaxies. Velocities and positions of these [OIII] features suggest that they may be produced when ambient gas has been compressed by an outmoving radio component, subsequently cools down behind the bow shock and then is photoionized by the nuclear continuum source. (author). 4 figs., 2 tabs., 13 refs.

27486 (INIS-mf–11401, pp. 343-344) **About the central regions of the Irrli galaxies - the members of tight groups and chains.** Iskudaryan, S.G. (AN Armyanskoj SSR, Byurakan. Astrofizicheskaya Observatoriya). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

GALAXIES/galaxy nuclei; COSMIC DUST; GALAXIES; H2 REGIONS

27487 (INIS-mf–11401, pp. 341-342) **Optical and radio properties of spirals in the Virgo cluster.** Guiricin, G. (Trieste Univ. (Italy)); Mardirossian, F.; Mezzetti, M.; Ramella, M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

An examination of the radio and optical properties of Virgo spirals indicates that the ratio of the radio continuum-to-optical luminosity of spirals is linked to their HI content. Specifically, HI deficient spirals tend to be weaker radio continuum emitters. (author). 1 tab., 11 refs.

27488 (INIS-mf–11401, pp. 337-339) **Dust grains in galactic haloes.** Barsella, B. (Pisa Univ. (Italy)); Ferrini, F.; Ferrara, A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The radiation and gravitational forces on dust grains from the disk are evaluated for a large sample of spiral galaxies. The main results are a selective expulsion of grains and the presence of equilibrium positions inside the halo, providing a new test for the distribution of dark matter. (author). 6 figs., 1 tab., 11 refs.

27489 (INIS-mf–11401, pp. 335-336) **Near infrared morphology of M 32.** Cepa, J. (Instituto de Astrofisica de Canarias, Tenerife (Spain)); Prieto, M.; Beckman, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Near infrared photometric observations in filters J and K of M 32 are presented. Isophotal maps with an angular resolution of 93 pc are presented, radial J, K averaged profiles are derived and the characteristic surface brightness and effective radius are obtained. The isophotal maps show a major axis angular displacement of 25deg with respect to the position angle measured by previous authors from B band observations. (author). 2 figs., 1 tab., 14 refs.

27490 (INIS-mf–11401, pp. 331-334) **2.2 micron stellar counts at the Galactic Plane.** Garzon, F. (Instituto de Astrofisica de Canarias, Tenerife (Spain)). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

2.2 micron maps are presented of selected areas of the Galactic Plane, taken with the 1.5 m Sanchez-Magro telescope on the island of Tenerife. A model of the galactic stellar distribution has been developed and the derived stellar surface densities are compared with the observations. The results are in good agreement with the experimental data and suggest remarkable differences between the luminosity functions for the disk and the spheroid components. The extinction toward the galactic centre shows an abrupt increase when compared with other galactic directions. A better fit is obtained when the 5 Kpc ring is included in the model. The existence of a thick disk cannot be inferred from the obtained data. (author). 4 figs., 16 refs.

27491 (INIS-mf–11401, pp. 327-330) **Potentials separable in addition for Chandrasekhar models with axial symmetry.** Subirana, J.S. (Departament de Matematiques, Universitat Politecnica de Catalunya (Spain)); Zornoza, J.M.J.; Poch, C.M.A. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The postulates for a non-stationary stellar system are presented, under the hypothesis of separability, for a stellar model that verifies the Chandrasekhar postulates, with axial symmetry (non-cylindrical), and with an equatorial plane of symmetry. The obtained results generalize those of the cylindrical case. As in the cylindrical case, there appears a term which can be interpreted as a contribution due to the galactic halo. As in the cylindrical case, the term appears proportional to ω-bar^2 although its coefficient of proportionality is now a function of the θ angle and shows a singular behavior. Finally, a term due to the non-inertiality of the galactic plane, regarded as the plane of symmetry of the stellar system, is obtained. (author). 6 refs.

27492 (INIS-mf–11401, pp. 323-326) **Kinematic model of the Galaxy.** Robin, A.C. (Observatoire de Besancon (France)); Oblak, E. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional

astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A kinematic model is developed based on a dynamical model of stellar population synthesis. The model predictions are compared with two proper motion catalogues. (author). 2 figs., 15 refs.

27493 (INIS-mf–11401, pp. 433-435) **Formation of neutrino halos.** Stuchlik, Z. (Technical University, Ostrava-Poruba (Czechoslovakia). Department of Physics). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A fully general relativistic non-linear model of the formation of massive neutrino halos in an Einstein-Straus universe was given by Fabbri, Jantzen and Ruffini. The role is considered here which a non-vanishing repulsive cosmological constant $\Lambda>0$, admissible by observational limits, can play in the FJR model for massive neutrinos with mass ~10 eV, indicated by recent observations of SN 1987a. On the other hand, the cosmological constant is relevant in the model if neutrinos have a low mass of <0.2 eV. (author). 9 refs.

27494 (INIS-mf–11401, pp. 437-438) **Thin shells and cosmological models.** Langer, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The closed universe consisting of two spherical voids separated by a thin shell of matter is studied in the framework of Israel formalism. It is shown that this model has no horizon. A naive quantization removing the singularity is performed. (author). 1 fig., 3 refs.

27495 (INIS-mf–11401, pp. 427-431) **Exact models of gravitational waves in the inflationary universe.** Bicak, J. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni); Podolsky, J. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Most of the work on exact models representing gravitational waves in general relativity has been concerned with space-times which are, at least in some directions, asymptotically flat. Gravitational waves are treated in one of the simplest, curved cosmological models. A physical interpretation is given of exact "type N solutions" of Einstein's equations with cosmological constant presented recently by Garcia Diaz and Plebanski. It is shown that some of these solutions may be interpreted as gravitational waves propagating in the de Sitter universe. (According to present consensus, this universe represents the inflationary stage of our Universe.) The analysis also reveals that the solutions can serve as the illustration of the cosmological non-hair theorem: they approach the de Sitter space-time asymptotically in time. (author). 1 fig., 9 refs.

27496 (INIS-mf–11401, pp. 445-447) **Isotropy of the X-ray background and the distribution of galaxies.** Meszaros, A. (Karlova Univ., Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni); Meszaros, P. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Three essentially different models of galaxy distribution are currently in use: the supercluster model, the void model, and the sponge model. If the hard X-ray background radiation is the sum of the radiation of unresolved discrete sources at large cosmological distances, then it is quite possible that these sources also exhibit the large scale structure of galaxies. The HEAO-A limits on the intensity fluctuations of the X-ray background are used to discriminate between three distribution models. These observations indicate a preference for the sponge-like model. (author). 10 refs.

27497 (INIS-mf–11401, pp. 449) **About the first spectrum of a galaxy.** Bronkalla, W. (Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Astrophysik); Oleak, H. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

NEBULAE/emission spectra; GALAXIES; NEBULAE; SPIRAL CONFIGURATION

27498 (INIS-mf–11401, pp. 451-464) **CO and H_2 in our galaxy.** Sanders, D.B. (California Inst. of Tech., Pasadena (USA)); Scoville, N.Z. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

During the last decade, millimeter wave observations of the CO molecule have proved to be one of the most important probes of the large scale structure and kinematics of the galactic disk. CO surveys show a strong concentration of molecular gas in the galactic center region and at a distance of 0.4-0.8 R_0 often referred to as the "galactic ring". The shape of the CO radial distribution is similar to nearly all other tracers of population I material, but quite different from the flat distribution of HI. Recent high-resolution surveys allow an unprecedented view of individual molecular clouds throughout the disk on all size scales between a few parsecs and many kiloparsecs. Massive, giant molecular clouds are the dominant reservoir of interstellar matter in the inner galaxy, and are the main active star forming component of the interstellar medium. The theoretical and empirical basis for using the 2.6 mm Co emission line as a tracer of H_2 is reviewed and the galactic distribution and properties of the molecular clouds are summarized. (author). 22 figs., 5 tabs., 53 refs.

27499 (INIS-mf–11401, pp. 401-420) **Cosmology: theory and observations.** Lukash, V.N. (Space Research Institute, Moscow (USSR)); Novikov, I.D. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A survey is presented of basic characteristics of new cosmological theories. The theory is explained of the very early universe, the so-called inflationary universe. Some new observations are presented as are results of new cosmological experiments. Briefly described are cosmological models of galaxy formation: cold dark matter models, unstable dark matter models, hierarchical explosions and string models. In conclusion, partial problems are outlined which may be resolved in current or future experiments. (M.D.). 3 figs., 2 tabs., 36 refs.

27500 (INIS-mf–11401, pp. 441-443) **Possible interpretation of the Central Void in the Jagiellonian Field.** Grabinska, T. (Politechnika Wroclawska (Poland)); Zabierowski, M. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

The problem of interpreting the so-called Central Void (CV) in the Jagiellonian Field (JF) is considered. The galaxies in JF are inclined to group around CV into a pallium-like configuration. The popular suggestion that CV may reflect a really existing and genuinely empty volume of the inter-multicluster space is verified. So far no interstellar cloud has ever been regarded as a possible explanation because of: 1. the cosecant-type laws describing interstellar extinction in the Milky Way, which made the galactic extinction at b-72deg

improbable, 2. the claims of Zwicky's School that JF was free of extinction, 3. the traditional view that multiclustering was not caused by absorptive dusty clouds, i.e., that extended galaxy structures were not only apparent. The results, of the present work concern the conceptual foundations of the research programme contained in early works of Splawa-Neyman (superclusters of galaxies called "clouds") and recent searches of Batuski and Burns on a possible 300 Mpc filament of clusters of galaxies in Perseus-Pegasus. It is proved that a local dusty cloud is projected just onto the region of the Central Void. (author). 1 fig., 10 refs.

27501 (INIS-mf-11401, pp. 421-425) **Initial phase of cosmological evolution and the formation of structure in the universe.** Gottloeber, S. (Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Astrophysik); Haubold, H.J.; Muecket, J.P.; Mueller, V. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, CS, August 24, 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Order Number DE89609850/JAW. Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

A singularity-free inflationary cosmological model driven by a coherent scalar field and/or R^2 terms in the gravitational Lagrangian is presented. The different mechanisms are compared and their observational restrictions are discussed. The dark matter problem and the mode coupling effect connecting the formation of very large structures and population III objects find a natural place in the model. (author). 22 refs.

27502 (INIS-SU–77/A, pp. 142-145) **Thermal neutron field around Moon.** Antonov, A.V. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Goryachev, B.I.; Isakov, A.I.; Lin'kova, N.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Flux, angular and velocity distributions of thermal neutrons emitted by the Moon have been calculated for some distances from the Moon. 3 figs.

27503 (LBL–26895) **Physics of dense matter, neutron stars, and supernova.** Glendenning, N.K. Lawrence Berkeley Lab., CA (USA). Feb 1989. 8p. DOE Contract AC03-76SF00098. (CONF-8901121–1: 5. workshop on nuclear astrophysics, Tegernsee, DE, January 30, 1989). Order Number DE89010673/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Nuclear and astrophysical evidence on the equation of state of dense matter is examined. The role of hyperonization of matter in the development of proto-neutron stars is briefly discussed. 7 refs., 4 figs.

27504 (MPI-H–1989-V7) **Measuring the chemical composition of cosmic rays at $\simeq 10^{13}$ - 10^{15} eV by utilizing the solar and geomagnetic fields.** Heintze, J.; Lennert, P.; Polenz, S.; Schmidt, B.; Spitzer, J.; Brueckner, W.; Hofmann, W.; Povh, B. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Heidelberg Univ. (Germany, F.R.). Physikalisches Inst. 1989. 15p. Order Number DE89764694/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

According to a proposal of Lloyd-Evans (1985), the average charge of particles in the cosmic radiation near 10^{14} eV can be determined by observing the effect of the solar magnetic field on the Sun's shadow in the angular distribution of energetic primary cosmic ray particles. This suggestion is shown to be realizable with a new type of EAS-array proposed for the purpose of high energy γ-ray astronomy. The same measurement provides information on the integrated strength of the solar magnetic field. As the array will be sensitive and provide good angular resolution down to a few times 10^{12} eV, more detailed results on the primary composition near 10^{13} eV can be obtained by investigating the shape of the shadow of the Moon as affected by the geomagnetic field.

27505 (N–89-15806) **Astrometric observations of comets and asteroids and subsequent orbital investigations. Semiannual progress report No. 30, 1 May-31 October 1988.** Mccroskey, R.E.; Marsden, B.G. Smithsonian Astrophysical Observatory, Cambridge, MA (USA). Nov 1988. 9p. (NASA-CR–183000; NAS–1.26:183000). Available from NTIS, PC A02/MF A01.

The 155-cm reflector was used for observations of comets and minor planets on 28 nights during April-October. Twenty-two of the observations refer to comets, 62 to numbered minor planets (numbered, that is, by the end of the semester: only nine of them refer to minor planets already numbered at the time of the last report), and the remainer to unnumbered minor planets. Observations were made of four new comets discovered during the semester and a fifth discovered in January. Observations of Wilson (19861), P/Tempel 2 and two other returning short-period comets are also continuing. Among the odd numbered minor planets observed were the earth-approaching objects (1685) Toro and (1980) Tezcatlipoca. The Earth approacher 1980 PA was numbered (3908).

27506 (N–89-15844) **Part 1: aspects of lithospheric evolution on Venus. Part 2: thermal and collisional histories of chondrite parent bodies. Ph.D. Thesis.** Grimm, R.E. Massachusetts Inst. of Tech., Cambridge, MA (USA). Oct 1988. 329p. (NASA-CR–184588; NAS–1.26:184588). Available from NTIS, PC A15/MF A01.

The geological evolution of distinctly different kinds of solar system objects is addressed. Venus has been observed over the past decade by orbital radars on both American and Soviet spacecraft. These surface measurements provide clues to the structure and evolution of the lithosphere. The parent bodies of chondritic meteorites, thought to resemble asteroids, represent the other end of the size spectrum of terrestrial objects. Their early thermal and collisional histories may be constrained by the chemical and textural record preserved in meteorite samples. Impact craters on Venus have been observed by the Soviet Venera 15/16 spacecraft. A formalism is presented by which the size-frequency distribution of impact craters may be used to estimate upper bounds on the mean global rates of volcanic resurfacing and lithospheric recycling on that planet over the past several hundred million years. The impact crater density reported from Venera observations, indicates a mean volcanic flux no greater than 2 cu km/y. For the lowest estimated mean crater retention age of the surface of Venus imaged by Venera 15/16, the rate of lithospheric recycling on Venus does not exceed 1.5 sq km/y. Ordinary chondrite meteorites show textural and chemical patterns indicative of varying intensities of thermal metamorphism. The conventional onion-shell model, envisions highly metamorphosed material in the core and less intensely heated rocks near the surface, but none has been observed. A metamorphosed-planetesimal model is devised to explain this discrepancy. Thermal and collisional constraints are examined, and the model is found to be applicable only to highly insulating Al-26-rich planetesimals. An alternative model is presented.

27507 (N–89-16624) **Reports of planetary astronomy, 1988.** National Aeronautics and Space Administration, Washington, DC (USA). Aug 1988. 178p. (NASA-TM–4063; NAS–1.15:4063). Available from NTIS, PC A09/MF A01.

Summaries and highlights of recent accomplisments in planetary astronomy are given. Topics include asteroids, comets, planetary atmospheres, charge coupled devices, photometry, astronomical spectroscopy, infrared imagery, atmospheric composition, and spectrum analysis.

27508 (PB–89-148241/XAB) **CO survey of the Southern Coalsack.** Nyman, L.A.; Bronfman, L.; Thaddeus, P. Chalmers Univ. of Tech., Goeteborg (Sweden). Onsala Space Observatory. 1988. 17p. (REPT–88/30). Available from NTIS, PC EE02/MF A01.

The authors have made a complete survey of CO J=1–0 emission from the Southern Coalsack with 8.8' resolution, sampled every 0.125 deg, and covering 26.5 square degrees. In some regions the ^{13}CO J=1–0 line also was observed. A total mass of about 3500 solar masses was derived for the Coalsack. The CO emission has a very complex structure, with clumps and filaments and in places several velocity components. The agreement between optical extinction and the CO integrated intensity is very good, but in several cases the small, dense, dark globules in the Coalsack can not be

distinguished in CO emission, implying that the CO lines become optically thick already in the gas surrounding the globules. The CO excitation temperature is typically between 8 and 11 K. In the regions of the ^{13}CO observations a fairly high optical depth was derived, between 0.3 and 0.9, possibly with small enhancements toward globules. These CO data reveal no evidence for star formation in the Coalsack: the CO excitation temperature does not exceed 11.2 K anywhere, and in general, the lines are narrow.

27509 (PB–89-152086/XAB) **Solar-Geophysical Data Number 532, December 1988. Part 1 (prompt reports). Data for November, October 1988, and late data.** Coffey, H.E.; McKinnon, J.A. National Geophysical Data Center, Boulder, CO (USA). Dec 1988. 144p. (SGD–532-PT-1). Available from NTIS, PC A07/MF A01.

See also PB–88-249297 and PB–89-152094.

Contents include: detailed index for 1988; data for November 1988–IUWDS alert periods (advance and worldwide); solar-activity indices; solar flares; solar radio emission; standard mean solar magnetic field; data for October 1988–solar-active regions; sudden ionospheric disturbances; solar radio-spectral observations; cosmic-ray measurements by neutron monitor; geomagnetic indices; radio propagation indices; late data–solar radio spectral observations; geomagnetic sudden commencements/solar-flare effects September 1988.

27510 (PB–89-152094/XAB) **Solar-Geophysical Data Number 532, December 1988. Part 2 (comprehensive reports). Data for June 1988 and miscellaneous.** Coffey, H.E.; McKinnon, J.A. National Geophysical Data Center, Boulder, CO (USA). Dec 1988. 86p. (SGD–532-PT-2). Available from NTIS, PC A05/MF A01.

See also PB–89-152086.

Contents include: detailed index for 1988: data for june 1988–meudon carte synoptique; solar flares; solar radio bursts at fixed frequencies; solar x-ray radiation from GOES satellite; mass ejections from the sun; and active prominences and filaments.

27511 (PB–89-159602/XAB) **Space Environment Laboratory. Annual report - FY 1988, October 1, 1987 to September 30, 1988.** National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab. Jan 1989. 50p. Available from NTIS, PC A03/MF A01.

See also report for FY 1987, PB–88-238811.

The report contains the major activities undertaken in FY 1987. The reader is reminded that space-environment disturbances are pseudo-cyclical in their characteristics, having about an 11-year period commensurate with the 11-year sunspot cycle.

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Refer also to citation(s) 27065, 27509, 27511

27512 (AD-A–202428/9/XAB) **Sounds in one-dimensional superfluid helium. Technical report.** Um, C.I.; Kahng, W.H.; Whang, M.H.; Hong, S.K.; Oh, H.G. State Univ. of New York, Buffalo, NY (USA). Dept. of Chemistry. Nov 1988. 32p. (UBUFFALO/DC–88/TR-88). Available from NTIS, PC A03/MF A01.

The temperature variations of first-, second- and third-sound velocity and attenuation coefficients in one-dimensional superfluid helium are evaluated explicitly for very low temperatures and frequencies (omega s tau << 1, where omega s is the sound frequency and tau the characteristic time), by using the collisionless kinetic equation and superfluid hydrodynamic equations with the energy-dissipation effect. The leading terms for these sounds vary as T^2, and the ratio of second-sound to first-sound becomes unity as the temperature decreases to absolute zero.

27513 (AD-A–202432/1/XAB) **Infrared spectral radiance code for the auroral thermosphere (AARC). Environmental research papers.** Winick, J.R.; Picard, R.H.; Joseph, R.A.; Sharma, R.D.; Wintersteiner, P.P. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 24 Nov 1987. 241p. (AFGL-TR–87-0334). Available from NTIS, PC A11/MF A01.

A first-principles scientific model for predicting the spectral radiance from the auroral thermosphere seen by an earthlimb observer is described. This model, and the resulting Auroral Atmospheric Radiance Code (AARC), describe the energy deposition in the thermosphere by primary auroral electrons and the ensuing effects. The latter include electron production and production of nonequilibrium concentrations of vibrationally and electronically excited states, by photochemical means, and by energy transfer. Relaxation of the states by collisions and radiation is described, and the transmission of the infrared radiation emitted from these states is treated. Currently, the model considers four radiators: the nitric oxide vibrational fundamental and first overtone at 2.8 and 5.3 micrometers the NO^+ fundamental at 4.3 mircometers, and the CO_2 asymmetric- stretch (NU -3 mode) emission at 4.3 micrometers. The prompt optically optically thin emitters (NO and NO^+) are treated in terms of stored, precalculated tables of efficiencies (photons per ion-pair).

27514 (AD-A–202446/1/XAB) **Stationary auroral-current oscillations resulting from the magnetospheric generator.** Weimer, D.R.; Maynard, N.C.; Burke, W.J.; Sugiura, M. Regis Coll., Weston, MA (USA). Research Center. 1 Oct 1988. 11p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 93, No. A10, 11436-11444(1 Oct 1988).

An instance of steady-state spatial current oscillations in auroral field-aligned currents was detected with the two Dynamics Explorer satellites. The oscillations are apparent in both the north-south electric fields and the east-west magnetic fields measured with DE-1 and DE-2 near a magnetic conjunction between the two satellites. Both satellites measured very similar, large-scale oscillations at the same location but separated in time by about 20 minutes. Three cycles with an average wavelength of approximately 266 km were detected. These waves, which consisted of alternating sheets of upward and downward currents, were imbedded within the Region 2 current system near 13 hours local time, at 66 to 73^0 invariant latitude. An explanation for these oscillations was developed in terms of a simple, steady-state model of the magnetosphere-ionosphere current system. The wavelength of the oscillations is found to be dependent on the ionospheric height-integrated Pedersen conductivity, the magnetic field-aligned conductivity, and the conductivity of a generator at the magnetospheric equator.

27515 (AD-A–202512/0/XAB) **Effects of ion collisions on quasi-linear heating by the current-driven ion-cyclotron instability in the high-latitude ionosphere. Memorandum report.** Satyanarayana, P.; Keskinen, M.J.; Chaturvedi, P.K.; Ossakow, S.L. Naval Research Lab., Washington, DC (USA). 14 Oct 1988. 25p. (NRL-Memo–6335). Available from NTIS, PC A03/MF A01.

Using an effective relaxation-time model, the effects of ion-ion and ion-neutral collisions on quasi-linear ion heating by the current-driven ion cyclotron instability in the high-latitude ionosphere were studied. For conditions typical of the high-latitude lower (200-300 km) F-region ionosphere, it is found that the combined effects of ion-neutral and ion-ion collisions tend to isotropize (S(tet)/T(par) approx. 1) the perpendicular T(per) and parallel S(tet) ion temperatures on time scales on the order of several tens to hundreds of NO^+ cyclotron periods for wave amplitudes e(phi)/T sub e = 0.2. Here, phi is the wave electrostatic potential, T(par) the electron temperature (in energy units), and e is the electron charge. In addition, for the high latitude upper (600 km) F-region ionosphere it is found that stronger anisotropy (T(per)/T(par) > 3) can be sustained even in the presence of ion collisions with waves with amplitudes e(phi)/T sub e = 0.2. For larger amplitude waves e(phi)/T sub e = 0.4, we find that the heating is weakly anisotropic at low altitudes (200-300 km) and strongly anisotropic at higher (600 km) altitudes. In both wave amplitude regimes (0.2 and 0.4), we find perpendicular ion heating factors of about 2-10 are found for altitudes in the range 300-600 km, with the larger perpendicular heating occurring at higher altitudes and larger wave amplitudes. The results are compared with recent rocket and satellite observations in the high-latitude ionosphere.

27516 (AD-A–203066/6/XAB) **Mechanisms for the source and loss of electrons. Progress report for period ending 30 November 1988.** Imhof, W.L.; Datlowe, D.W.; Voss, H.D.; Mobilia, J. Lockheed Missiles and Space Co., Palo Alto, CA (USA). Lockheed Palo Alto Research Lab. 1988. 21p. (LMSC/F–247028). Available from NTIS, PC A03/MF A01.

The objectives are to use available satellite particle and bremsstrahlung x-ray data as well as ground-based measurements to evaluate the source and loss mechanisms for electrons trapped throughout the radiation belts. Effort has concentrated on compiling the existing electron-precipitation data over a wide range of latitudes and comparing the electron data with available wave data. At midlatitudes, extensive effort was devoted to comparing the short duration bursts observed in the SEEP payload on the S81-1 satellite with narrow bursts in the wave data recorded. In several daytime cases, general agreement was obtained between chorus wave emission and electron-precipitation bursts, but one-to-one coincidences were not observed. The association of electron precipitation at nighttime with lightning generated whistlers is much better in several recently uncovered examples as well as earlier ones. A major contribution to the total electron precipitation rate is associated with those injected into the drift-loss cone. Much of the flux observed in the drift-loss cone is associated with the nearly monochromatic waves emitted from VLF transmitters, as indicated by narrow peaks in the energy spectra. Study of electron precipitation at high latitudes has benefited from use of bremsstrahlung x-ray data acquired on the SEEP payload as well as the P78-1 satellite. The x-ray spectrometers on P78-1 were very useful for studying the electron precipitation that regularly occurs near the trapping boundary.

27517 (AD-A–203172/2/XAB) **Commentary on fast atmospheric pulsations. Technical report.** Vampola, A.L. Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab. 22 Nov 1988. 19p. (TR–0088(3940-05)-6). Available from NTIS, PC A03/MF A01.

A recent paper proposed that Fast Atmospheric Light Pulsations (FAPs), which have been observed at L=1.5-2.2 in the northern hemisphere, are optical signatures of >2-MeV electrons associated with Lightning-induced Electron Precipitation (LEP) events produced by lightning strokes in the southern hemisphere. FAPs cannot be produced by >2-MeV electrons in the inner radiation belt because the upper limit for fluxes of such particles is only about 0.2% of the value that was used in the analysis and would lead to an unrealistically short electron lifetime. The discrepancy comes from using an electron model, AE-2, which included the Starfish fission electrons. Later inner-zone electron environment models show the inner-zone to have negligible fluxes of electrons in excess of 2 MeV. The use of a model in which southern hemisphere lightning strokes result in northern hemisphere FAPs via a cyclotron mode interaction between magnetospheric electrons and lightning generated waves is also untenable because it would result in FAP intensities two orders of magnitude greater in the southern hemisphere than in the northern hemisphere, leading to a further two orders of magnitude reduction in estimated inner-zone electron lifetimes. The estimated light intensity of FAPs is within acceptable bounds compared to the lifetime of inner zone electrons if all electrons above 100 keV contribute to the light production, if southern hemisphere FAP intensity is no greater than the FAP intensity observed in the northern hemisphere, and if the light-production efficiency is of the order of .001.

27518 (INIS-BR–1458, pp. 143) **Electrons measurements in the lower atmosphere near the South Atlantic Magnetic Anomaly.** Martin, I.M. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Bui-Van, N.A.; Turtelli Junior, A.; Stozhkov, Y.I.; Fradkin, M.I. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRONS/earth atmosphere; ELECTRONS/magnetic storms; ELECTRONS/southern hemisphere; BALLOONS; ELECTRONS; MEV RANGE 01-10; TELESCOPE COUNTERS

27519 (INIS-BR–1458, pp. 196) **X-ray measurements in the atmospheric environmental of Brazil.** Pinto Junior, O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Gonzalez, W.D. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X-RAY DETECTION/magnetic storms; X-RAY DETECTION/scintillation counters; BALLOONS; SOUTHERN HEMISPHERE

27520 (INIS-BR–1458, pp. 269) **Nonlinear analysis of noise in the transmission of infrared radiation in the atmosphere.** Babin, V. (Institutul de Fizica Atomica, Bucharest (Romania)); Campeanu, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INFRARED RADIATION/earth atmosphere; INFRARED RADIATION/transmission; FLUCTUATIONS; TRANSMISSION; NOISE; NONLINEAR PROBLEMS

27521 (PB–89-152482/XAB) **Ionogram analysis with the generalised program POLAN.** Titheridge, J.E. World Data Center A for Solar-Terrestrial Physics, Boulder, CO (USA). Dec 1985. 204p. (UAG–93). Available from NTIS, PC A10/MF A01.

Different methods for the real-height analysis of ionograms, and their fields of application, are surveyed. A flexible new procedure is developed to give maximum accuracy and reliability in an automatic, one-pass analysis. The POLynomial ANalysis program POLAN uses polynomial real-height sections of any required degree, fitting any number of data points. By choice of a single parameter (MODE) it can reproduce all current methods from linear-laminations to single or overlapping polynomials. In addition a wide range of least-squares modes are available; these are preferable for most purposes, particularly with oversampled data (as from digital ionosondes). The mode of analysis changes automatically within the program to give an optimized least-squares calculation in the start, peak and valley regions. Physically unacceptable solutions are adjusted by imposing limits on the profile parameters. The new profile coefficients (and the new fitting error) are obtained directly and rapidly from the previous solution. This permits repeated application of the adjustments, as required, and cancellation of any change if it produces an unacceptably large increase in the virtual-height fitting error.

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27522 (DOE/ER/13965–1) **Double resonance reactant preparation for state-to-state studies of unimolecular reactions: Progress report, August 15, 1988–August 14,1989.** Rizzo, T.R. Rochester Univ., NY (USA). 1989. 7p. DOE Contract FG02-88ER13965. Order Number DE89010621/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The goal of this work is to investigate unimolecular dissociation dynamics of highly vibrationally excited molecules at a sufficiently detailed level to provide unambiguous tests of statistical theories and dynamical calculations of the reaction dynamics. The testing and refinement of these models are important for quantitative prediction of reaction rates and energy partitioning in combustion reactions. This project involves using multiple laser techniques to investigate the intramolecular dynamics of small reactive molecules on a quantum state specific level. In one approach we use infrared-optical double resonance to prepare reactant molecules in quasibound vibrational and rotational states above their dissociation threshold and monitor their decomposition dynamics. In another approach we use the reverse process, optical-infrared double resonance, to examine the vibrational character of light atom stretching vibrations at chemically significant energies and learn about the intramolecular energy transfer from these modes. Our initial work using both of these techniques has been directed toward understanding the details of the unimolecular dissociation dynamics of hydrogen peroxide, since this system has attracted an increasing amount of attention from theoreticians. We have done some preliminary work on the decomposition t-butylhydroperoxide and are currently applying our techniques to several small nitrogen containing compounds including nitric acid, hydroxylamine and formaldoxime.

27523 (INIS-BR–1458, pp. 31) **Measurement of photoelectric cross-selections for X-ray photons at L_1 and L_{111} edges in Gd, Dy and Pb: T/L ratios at L_1-shell^{111} binding energy.** Rao, D.V. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3,

1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

DYSPROSIUM/binding energy; DYSPROSIUM/electronic structure; GADOLINIUM/binding energy; GADOLINIUM/electronic structure; LEAD/binding energy; LEAD/electronic structure; CROSS SECTIONS; DYSPROSIUM; GADOLINIUM; KEV RANGE 01-10; KEV RANGE 10-100; LEAD; MULTI-CHANNEL ANALYZERS; PHOTOELECTRIC EFFECT; PROPORTIONAL COUNTERS; X-RAY FLUORESCENCE ANALYSIS

27524 (INIS-BR–1458, pp. 17) **Expectation of LET ∞ of a tritium beta particle.** Saigusa, T. (Ryukoku Univ., Tokyo (Japan)); Shimizu, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BETA PARTICLES/let; BETA PARTICLES/tritium; TRITIUM/beta particles; TRITIUM/let; LET; TRITIUM; ENERGY LOSSES; ENERGY RANGE; ENERGY SPECTRA; EXPECTATION VALUE; FERMI INTERACTIONS; STOCHASTIC COOLING

27525 (INIS-BR–1458, pp. 10) **Theoretical description of subvalent shells photoionization.** Petrov, I.D. (Rostov Railway Engineers Inst., Rostov-on-Don (USSR). Chair of Physics); Sukhorukov, V.L. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ARGON/electronic structure; ARGON/photoionization; KRYPTON/electronic structure; KRYPTON/photoionization; METHANE/electronic structure; METHANE/photoionization; ARGON; PHOTOIONIZATION; CROSS SECTIONS; HARTREE-FOCK METHOD; KRYPTON; METHANE

27526 (INIS-BR–1458, pp. 7) **Photoabsorption on atomic ions: dependence on degree of ionization.** Kuang, Y. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy); Pratt, R.H.; Dong, Q. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NEON IONS/cross sections; NEON IONS/photoionization; NEON IONS/single-particle model; ATOMIC IONS; CENTRAL POTENTIAL; K SHELL; PHOTOIONIZATION

27527 (INIS-BR–1458, pp. 5) **Photoionization cross sections: present status and future needs.** Manson, S.T. (Georgia Univ., Athens (USA). Dept. of Physics and Astronomy). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PHOTOIONIZATION/cross sections; ACCURACY; EXCITED STATES; IONS; PHOTOIONIZATION

27528 (INIS-BR–1458, pp. 3) **Photoionization studies of atoms and molecules using synchrotron radiation.** Lindle, D.W. (National Bureau of Standards, Gaithersburg, MD (USA)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ATOMS/photoionization; ATOMS/synchrotron radiation; MOLECULES/photoionization; MOLECULES/synchrotron radiation; ATOMS; PHOTOIONIZATION; MOLECULES

27529 (INIS-BR–1458, pp. 41) **Energy dependence of the total cross section for negaton-positon pair creation by gamma quanta in liquid xenon measured in bubble chambers.** Strugalski, Z. (Warsaw Univ. (Poland)); Alrohiah, M.; Miller, K.; Pawlak, T.; Peryt, M.; Pluta, J.; Tunia, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRONS/energy dependence; ELECTRONS/pair production; ELECTRONS/total cross sections; PAIR PRODUCTION/bubble chambers; POSITRONS/energy dependence; POSITRONS/pair production; POSITRONS/total cross sections; ELECTRONS; GAMMA RADIATION; LIQUIDS; MEV RANGE 10-100; MEV RANGE 100-1000; POSITRONS; XENON

27530 (INIS-BR–1458, pp. 22) **Creation of relativistic beams of fermionium.** Olsen, H.A. (Trondheim Univ. (Norway). Inst. for Fysikk). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON-ATOM COLLISIONS/positronium; ELECTRON-ATOM COLLISIONS/relativistic range; BOUND STATE; CROSS SECTIONS; ELECTRON BEAMS; POSITRONIUM; FERMIONS

27531 (INIS-BR–1458, pp. 93) **X-rays and charge-exchange collisions.** Montenegro, E.C. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ION-ATOM COLLISIONS/coincidence methods; ION-ATOM COLLISIONS/x radiation; CHARGE STATES; METASTABLE STATES

27532 (INIS-BR–1458, pp. 46) **Small-angle coherent gamma-ray scattering at 662 KeV for Pb and Sn.** Bradley, D.A. (Sains Malaysia Univ.. School of Physics); Chong, C.S.; Tajuddui, A.A.; Shukri, A.; Ghose, A.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COHERENT SCATTERING/small angle scattering; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; GAMMA RADIATION; KEV RANGE 100-1000; LEAD; MOMENTUM TRANSFER; TIN

27533 (INIS-BR–1458, pp. 39) **Beta induced thick target bremsstrahlung.** Gopala, K. (Mysore Univ. (India). Dept. of Studies in Physics); Venkataramaiah, P.; Sanjeeviah, H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BREMSSTRAHLUNG/beta particles; BREMSSTRAHLUNG/targets; BREMSSTRAHLUNG; TARGETS; CROSS SECTIONS; ENERGY DEPENDENCE

27534 (INIS-BR–1458, pp. 38) **Experimental studies on coherent scattering of 59.54 KeV gamma rays.** Siddappa, K. (Mangalore Univ. (India). Dept. of Studies in Physics); Nayak, N.G.; Balakrishna, K.M.; Lingappa, N.; Shivaramu. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COHERENT SCATTERING/gamma radiation; COHERENT SCATTERING/kev range 10-100; ATOMIC NUMBER; DIFFERENTIAL CROSS SECTIONS; ENERGY DEPENDENCE; FORM FACTORS

27535 (INIS-BR–1458, pp. 37) **Inelastic scattering of protons by bound atomic electrons.** Paul, N.C. (North Bengal Univ., Darjeeling (India). Dept. of Physics); Das, S.C.; Basak, D.K.; Chaudhuri, N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4.

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INELASTIC SCATTERING/differential cross sections; INELASTIC SCATTERING/energy dependence; INELASTIC SCATTERING/photon beams; PHOTON BEAMS/differential cross sections; PHOTON BEAMS/energy dependence; ALUMINIUM; GOLD; KEV RANGE 100-1000; LEAD; TIN

27536 (INIS-BR–1458, pp. 34) **Measurements of incoherent scattering cross section of gamma photons by K-shell electrons of heavy atoms.** Paul, N.C.; Maharidyalaya, S.; Dhupguri, P.O. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

K SHELL/heavy nuclei; K SHELL/incoherent scattering; K SHELL/photon-electron interactions; CROSS SECTIONS; GAMMA RADIATION; MULTI-CHANNEL ANALYZERS

27537 (INIS-BR–1458, pp. 21) **X-ray absorption in atoms under intense radiation fields.** Fonseca, A.L.A. (Brasilia Univ., DF (Brazil). Dept. de Fisica); Nunes, A.C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ATOMS/absorption; ATOMS/x radiation; ATOMS; ABSORPTION; CROSS SECTIONS; MATHEMATICAL MODELS; PHOTONS; POLARIZED BEAMS

27538 (INIS-BR–1458, pp. 20) **Exact Calculation of internuclear Bremsstrahlung in Ion-solid collisions.** Pacher, M.C. (Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires (Argentina). Inst. de Astronomia y Fisica del Espacio); Miraglia, J.E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM/solids; ALUMINIUM/targets; ION COLLISIONS/internal bremsstrahlung; ION COLLISIONS/proton beams; ION COLLISIONS/targets; ALUMINIUM; SOLIDS; TARGETS; ANGULAR DISTRIBUTION; ASYMMETRY; INCIDENCE ANGLE; MEV RANGE 01-10; PIXE ANALYSIS

27539 (INIS-BR–1458, pp. 19) **Double atomic-field Bremsstrahlung from thick targets.** Lehtihet, H. (Texas Christian Univ., Fort Worth (USA)); Quarles, C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

TAGGED PHOTON METHOD/bremsstrahlung; TAGGED PHOTON METHOD/inelastic scattering; TAGGED PHOTON METHOD/targets; CADMIUM 109; COULOMB FIELD; CROSS SECTIONS; ENERGY DEPENDENCE; GOLD; KEV RANGE 10-100; LEAD; SILVER; BREMSSTRAHLUNG; TARGETS; TANTALUM

27540 (INIS-BR–1458, pp. 18) **Rayleigh scatterring from ions near threshold.** Roy, S.C. (Bose Research Inst., Calcutta (India). Dept. of Physics); Gupta, S.K.S.; Kissel, L.; Prate, R.H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RAYLEIGH SCATTERING/neon; RAYLEIGH SCATTERING/threshold energy; ANGULAR DISTRIBUTION; COMPARATIVE EVALUATIONS; PHOTONS; POTENTIALS; NEON; TOTAL CROSS SECTIONS

27541 (INIS-BR–1458, pp. 15) **Cross section calculations using the charge density approach.** Tung, C.J. (Tsinghua Univ. National, Taiwan (China). Inst. of Nuclear Science). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INELASTIC SCATTERING/charge density; INELASTIC SCATTERING/differential cross sections; INELASTIC SCATTERING/mathematical models; ENERGY LOSSES; MEAN FREE PATH; OSCILLATOR STRENGTHS; STOPPING POWER

27542 (INIS-BR–1458, pp. 14) **Study of anomaly dispersion in elastic scattering of 59.5 KeV photons near K-absorption edges of target atoms.** Ghose, S.K. (North Bengal Univ., Darjeeling (India). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELASTIC SCATTERING/cross sections; ELASTIC SCATTERING/k absorption; K ABSORPTION/atoms; K ABSORPTION/kev range 10-100; K ABSORPTION/photon beams; DISPERSION RELATIONS; ATOMS; TARGETS

27543 (INIS-BR–1458, pp. 13) **K-shell Ionization by antiprotons in Ag.** Sheth, C.V. (Zambia Univ., Lusaka. Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INNER-SHELL IONIZATION/antiproton beams; INNER-SHELL IONIZATION/k shell; INNER-SHELL IONIZATION/silver; SILVER; RECOILS; RELATIVISTIC RANGE

27544 (INIS-BR–1458, pp. 9) **Many-electron during inner shell ionization in atoms.** Sukhorukov, V.L. (Rostov Railway Engineers Inst., Chair of Physics, Rostov-on-Don (USSR)); Hopersky, A.N.; Yavna, V.A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INNER-SHELL IONIZATION/atoms; INNER-SHELL IONIZATION/electronic structure; ARGON; ENERGY SPECTRA; HARTREE-FOCK METHOD; ATOMS; KRYPTON; NEON; SODIUM; THRESHOLD ENERGY; XENON

27545 (INIS-BR–1458, pp. 8) **Calculation of electron mean free paths and backscattering factors within the first Born's approximation.** Bir'ukov, A.P. (Rostov Railway Engineers Inst., Rostov-on-Don (USSR). Chair of Physics); Sukhorukov, V.L. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CARBON/backscattering; CARBON/born approximation; CARBON/mean free path; SILICON/backscattering; SILICON/born approximation; SILICON/mean free path; AUGER ELECTRON SPECTROSCOPY; CARBON; BACKSCATTERING; CROSS SECTIONS; ELECTRONIC STRUCTURE; HARTREE-FOCK METHOD; IONIZATION; SILICON

27546 (INIS-BR–1458, pp. 110) **On the energy dependence of effective atomic numbers.** Subba Rao, K. (Regional Engineering Coll., Warangal (India). Dept. of Physics); Ramalingeswara Rao, A.V.N.; Krishna Murty, V.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number

DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LEAD COMPOUNDS/atomic number; LEAD COMPOUNDS/energy dependence; MERCURY COMPOUNDS/atomic number; MERCURY COMPOUNDS/energy dependence; TIN COMPOUNDS/atomic number; TIN COMPOUNDS/energy dependence; CROSS SECTIONS; KEV RANGE 100-1000; MEV RANGE 01-10; PHOTON-ATOM COLLISIONS

27547 (INIS-BR–1458, pp. 103) **Study of the effect of multi-electron excitation on the exafs of low-Z atoms.** Kochur, A.G. (Rostov Railway Engineers Inst., Rostov-on-Don (USSR). Chair of Physics); Nadolinsky, A.M.; Demekhin, V.F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FLUORINE IONS/excitation; FLUORINE IONS/k absorption; FLUORINE IONS/monopoles; ABSORPTION SPECTRA; EXCITATION; MONOPOLES; THRESHOLD ENERGY

27548 (INIS-BR–1458, pp. 101) **K-shell x-ray emission cross section by proton bombardment.** Rosato, E. (Naples Univ. (Italy). Ist. di Fisica). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INNER-SHELL IONIZATION/cross sections; INNER-SHELL IONIZATION/proton beams; K SHELL/inner-shell ionization; X-RAY EMISSION ANALYSIS

27549 (INIS-BR–1458, pp. 140) **Thermoluminescent parameters from Brazilian calcite glow curve.** Lima, J.F. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Yoshimura, E.M.; Okuno, E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CALCITE/glow curve; CALCITE/irradiation; CALCITE/thermoluminescent dosemeters; ACTIVATION ENERGY; ANNEALING; CALCITE; IRRADIATION; GAMMA RADIATION; TEMPERATURE DEPENDENCE

27550 (INIS-BR–1458, pp. 127) **Structural investigations of some copper complexes by exafs technique.** Saxena, S.G. (Banasthali Vidyapith (India)); Sinha, A.I.P.; Rekha Govil; Garg, K.B. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

COPPER COMPLEXES/molecular structure; COPPER COMPLEXES/multiple scattering; BOND ANGLE; BOND LENGTHS; STEREOCHEMISTRY

27551 (INIS-BR–1458, pp. 114) **Experimental studies on thick-targets EB spectra of ^{32}P beta particles.** Ahmad, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BREMSSTRAHLUNG/energy spectra; BREMSSTRAHLUNG/targets; PHOSPHORUS 32/beta particles; PHOSPHORUS 32/bremsstrahlung; ALUMINIUM; BETHE-HEITLER THEORY; BREMSSTRAHLUNG; TARGETS; COPPER; KEV RANGE 100-1000; LEAD; MAGNETIC FIELDS; PERSPEX; SILVER; TUNGSTEN

27552 (INIS-BR–1458, pp. 112) **Study of molecular correlations observed in the small-angle photon scattering distributions of 60 KeV photons interacting with low atomic number media.** Bradley, D.A. (Royal Marsden Hospital, London (UK)); Dance, D.R.; Evans, S.H.; Jones, C.H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PHOTON-ATOM COLLISIONS/kev range 10-100; PHOTON-ATOM COLLISIONS/small angle scattering; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; METHACRYLATES; METHYL RADICALS; NYLON; TOTAL CROSS SECTIONS; WATER

27553 (INIS-BR–1458, pp. 259) **Use of the form factor formalism in crystallography.** Greagh, D.C. (New South Wales Univ., Compbell (Australia)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FORM FACTORS/crystal structure; FORM FACTORS/mathematical models; X-RAY DIFFRACTION

27554 (INIS-mf–11410) **Energy redistribution in the dissociation of low Rydberg states of HeH and 0_2.** Zande, W.J.A. van der. Amsterdam Univ. (Netherlands). 24 Aug 1988. 150p. Order Number DE89609587/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Includes summary in Dutch.

In this thesis the dissocation process is studied of the diatomic molecules, heliumhydride and molecular oxygen. In ch.'s 2-4 results on the spectroscopy and dissociative decay of the excited states of heliumhydride (HeH) are explained. The positions and dissociation pathways of the $A^2\Sigma^+$ and $B^2\Pi$ states are determined and a theoretical description of the decay of these states are given. An isotope dependent dissociation behaviour of the C^2/σ^+ Rydberg state is reported which explained with this theory. In ch.'s 5-7 observations are presented regarding the first Rydberg states of molecular oxygen. The spectroscopy of the $(3s\sigma)d\ ^1\Pi_g$ and $C^3\Pi_g$ states is treated, and the stability and decay of these Rydberg states is discussed qualitatively. An experimental study is described of the $(3s\sigma)d\ ^1\Pi_g$, v=4-8 states. By isotope studies and resolving rotational lines and the measurements of natural linewidths quantitative estimates have been acquired on coupling strengths, positions of repulsive valence states and perturbations reported in literature from REMPI experiments. The electronic coupling strengths between the $C^3\Pi_g$ state and the $^3\Pi_g$ valence state has been established. Observed spin-orbit interactions have been quantified and the dissociation of the multiplet states ($C^3\Pi_{g,\omega=0-2}$) has been correlated with the multiplet states of the fragment $O^3P_{J=0-2}$. The spectroscopy of the $(3s\sigma 3)$ Rydberg states which con- verge to and are formed in collisions with the O^+_2, $a^4\Pi_\mu$ ion state, is treated. The $(3s\sigma)^5/\pi_\mu$ state competition between auto-ionizations and (pre-)dissociation has been observed. 207 refs.; 36 figs.; 18 tabs.

27555 (JINR–R-11-88-225) **Numerical simulation of superconducting focusing magnetic system.** Zhidkov, E.P.; Kartashov, S.V.; Ovsyannikov, V.P.; Polyakova, R.V.; Khoromskij, B.N. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1988. 6p. (In Russian). Order Number DE88706332/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A numerical analysis of the parameters of an axially symmetric magnetic system for the cryogenic electron-beam ion isator is presented. These calculations allow one to determine an admissible configuration of magnetic poles and to study their influence on the magnetic field change. 7 refs.; 4 figs.

27556 Electron photoemission predictions with CEPXS/ONETRAN. Lorence, L.J. Jr. (Sandia National Labs., Albuquerque, NM (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1288-1293 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The accuracy and efficiency of electron photoemission predictions with CEPXS/ONETRAN is assessed by comparisons to both TIGERP and experiment.

27557 Comparison of experimental and calculated attachment rate constants for $CFCl_3$ and CCl_4 in the temperature range 294–500 K. Orient, O.J. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109); Chutjian, A.; Crompton, R.W.; Cheung, B. *Physical Review [Section] A: General Physics (USA),* 39(9): 4494-4501 (1 May 1989).

Electron-attachment cross sections and rate constants have been measured and calculated for the dissociative attachment processes $e+CFCl_3 \rightarrow Cl^- + CFCl_2$ and $e+CCl_4 \rightarrow Cl^- + CCl_3$. Good agreement over the electron-energy range 1–200 meV is found in energy dependence between present calculated cross sections and experimental (krypton photoionization) cross sections at 300 K. The same calculation, with suitable adjustment of thermal populations, was used to calculate electron-attachment rate constants k(epsilon-c-bar) in the range 50–600 K. Experimental rate constants for $CFCl_3$ and CCl_4 were measured at temperatures of 294, 404, and 496 K ($CFCl_3$) and 294, 400, and 500 K (CCl_4) using the Cavalleri electron-density sampling method. Good agreement is found between present measurements and calculations, poor agreement with flowing-afterglow Langmuir-probe (FALP) data in $CFCl_3$ at the higher temperatures, and reasonable agreement with FALP data for CCl_4.

27558 Gaussian-1 theory: A general procedure for prediction of molecular energies. Pople, J.A. (Department of Chemistry, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213); Head-Gordon, M.; Fox, D.J.; Raghavachari, K.; Curtiss, L.A. *Journal of Chemical Physics (USA),* 90(10): 5622-5629 (15 May 1989).

A general procedure is developed for the computation of the total energies of molecules at their equilibrium geometries. Ab initio molecular orbital theory is used to calculate electronic energies by a composite method, utilizing large basis sets (including diffuse-sp, double-d' and f-polarization functions) and treating electron correlation by Moeller–Plesset perturbation theory and by quadratic configuration interaction. The theory is also used to compute zero-point vibrational energy corrections. Total atomization energies for a set of 31 molecules are found to agree with experimental thermochemical data to an accuracy greater than 2 kcal mol^{-1} in most cases. Similar agreement is achieved for ionization energies, electron and proton affinities. Residual errors are assessed for the total energies of neutral atoms.

6404 Fluid Physics

Refer also to citation(s) 26783, 27334

27559 (CONF-8809335–1) **Periodic and solitary waves on thin, horizontal, gas-sheared liquid films.** Jurman, L.A.; Bruno, K.; McCready, M.J. Notre Dame Univ., IN (USA). Dept. of Chemical Engineering. 1988. 41p. DOE Contract FG02-88ER13913. From 2. international symposium on annular and dispersed flows; Oxford, GB; September 6, 1988. Order Number DE89010655/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Measurements of wavelengths and speeds of periodic waves which occur at the interface of thin, horizontal, liquid films sheared by a cocurrent gas flow are compared with predictions of linear theory. In general, linear predictions accurately match the data near the point of neutral stability but begin to deviate as the gas velocity increases. The behavior away from neutral stability is explained by the examination of the dynamical system associated with steady solutions to a nonlinear wave equation based on boundary-layer approximations. Periodic waves are seen to occur in the neighborhood of the Hopf curve which serves as a boundary between periodic waves and a flat film. Solitary waves (which correspond under some circumstances to disturbance or roll waves) are observed to lie in another region of parameter space at gas velocities well above neutral stability. These results suggest that a complete nonlinear analysis of the boundary-layer (or associated wave) equations would be useful for predicting amplitudes and speeds for periodic waves and the regions of occurrence for solitary waves. 38 refs., 10 figs.

27560 (DOE/ER/13913–1) **Study of interfacial behavior in concurrent gas-liquid flows: Progress report, 1 May 1988–30 April 1989.** McCready, M.J. Notre Dame Univ., IN (USA). Dept. of Chemical Engineering. Feb 1989. 18p. DOE Contract FG02-88ER13913. Order Number DE89010484/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research is focused on acquiring an understanding of the fundamental processes which occur within the liquid layer of separated (i.e., annular or stratified) gas-liquid flows. Knowledge of this behavior is essential for interpretation of pressure drops, entrainment fraction, transport processes and possibly flow regime transitions in gas-liquid flows. We are examining the qualitative and quantitative nature of the interface, using this information to predict the behavior of the flow field within the film and also studying the effect of the flow field on interface and wall heat and mass transfer rates. Study of waves on sheared liquid layers is best broken into two limiting cases, film depth ratio to wavelength ratio ($varepsilon$) much less than one (typical of annular flows) and $varepsilon \geq 1$ (typical of stratified flows). Our study of waves where $varepsilon$ = O(1) has shown that wave amplitude spectrum is determined by overtone interactions between various modes which lead to a net flux of energy from low (where it is fed in from gas shear) to high frequency waves (where it is dissipated). Interfacial shear and film depth determine the interaction rates and therefore the spectral shape. Using a balance equation for wave energy, we developed a procedure for quantitatively predicting the wave spectrum. For waves with $varepsilon << 1$, it is appropriate to examine individual traveling wave shapes (rather than the wave spectrum). We have found that measured wavelengths and speeds of periodic waves exhibit small but significant deviations from predictions of linear stability theory. 7 refs., 3 figs.

27561 (LA-UR–89-518) **Shock waves and fragmentation via molecular dynamics.** Holian, B.L. Los Alamos National Lab., NM (USA). 1989. 8p. DOE Contract W-7405-ENG-36. (CONF-8904121–1: Supercomputing and third world supercomputer exhibition, Santa Clara, CA, US, April 30, 1989). Order Number DE89007981/JAW. Available from NTIS, PC A02 - OSTI.

A wide variety of nonequilibrium processes can be investigated from the atomistic viewpoint by the method of molecular dynamics (MD), where the equations of motion of thousands of interacting atoms are solved on the computer. MD simulations of shock waves in three- dimensional fluids have shown conclusively that shear-stress relaxation is achieved through the atomic rearrangement of transverse viscous flow, for which Navier-Stokes hydrodynamics has been shown to be accurate. MD simulations of homogeneous adiabatic expansion have provided significant insight into the process of fragmentation for hot dense fluids, in that the fragment distribution is exponential in fragment mass; moreover, the average mass can be reasonably estimated by a simple model based on energy balance. Finally, both compression and expansion are involved when a high-velocity sphere impacts and penetrates a thin wall; an atomistic (MD) simulation of this highly nonequilibrium flow resembles in many ways the continuum (hydrodynamic) simulations. 13 refs., 10 figs.

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 27015, 27023, 27030

27562 (LA–11502-MS) **Parameterization of pion production and reaction cross sections at LAMPF energies.** Burman, R.L.; Smith, E.S. Los Alamos National Lab., NM (USA). May 1989. 31p. DOE Contract W-7405-ENG-36. Order Number DE89011120/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A parameterization of pion production and reaction cross sections is developed for eventual use in modeling neutrino production by protons in a beam stop. Emphasis is placed upon smooth parameterizations for proton energies up to 800 MeV, for all pion energies and angles, and for a wide range of materials. The resulting representations of the data are well-behaved and can be used for extrapolation to regions where there are no measurements. 22 refs., 16 figs., 2 tabs.

27563 (LA-UR–89-1173) **Status of the Los Alamos tritium beta decay experiment.** Robertson, R.G.H.; Bowles, T.J.; Wark, D.L.; Wilkerson, J.F.; Knapp, D.A. Los Alamos National Lab., NM

(USA). 1989. 14p. DOE Contract W-7405-ENG-36. (CONF-890199–3: 8. Moriond workshop on tests of fundamental laws in physics, Les Arcs, FR, January, 1989). Order Number DE89011193/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Los Alamos tritium experiment employs a gaseous tritium source and a magnetic spectrometer to determine the mass of the electron antineutrino from the shape of the tritium beta spectrum. Since publication of the first result from this apparatus (m_{nu} < 27 eV at 95% confidence), work has concentrated on improving the data rates. A 96-element Si microstrip array detector has been installed to replace the single proportional counter at the spectrometer focus, resulting in greatly increased efficiency. Measurements of the 1s photoionization spectrum of Kr now obviate the need for reliance on the theoretical shakeup and shakeoff spectrum of Kr in determining the spectrometer resolution. 19 refs., 3 figs.

27564 (LBL–26547) **Perspective on TeV-scale physics.** Chanowitz, M.S. Lawrence Berkeley Lab., CA (USA). Feb 1989. 52p. DOE Contract AC03-76SF00098. (CONF-8808182–4: Heavy flavor physics symposium, Beijing, CN, August 10, 1988). Order Number DE89010678/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

These lectures review theoretical motivations and experimental prospects for the study of TeV-scale physics. Three clues to the importance of TeV physics are discussed: implications of quantum corrections for the masses of a fourth generation quark-lepton family, the gauge hierarchy problem and known solutions, and implications of symmetry and unitarity for the symmetry-breaking sector of the electroweak gauge theory. The experimental prospects are reviewed with emphasis on the multi-TeV pp colliders that may be built in the 1990's. The topics include new phenomena that might occur - e.g., a fourth generation, heavy gauge bosons, composite structure, and supersymmetry - as well as the signals of the unknown $SU(2)_L \times U(1)_Y$ breaking mechanism that must occur within the TeV domain. 96 refs., 21 figs.

6452 Particle Interactions and Properties - Theoretical

27565 (INIS-BR–1458, pp. 23) **Hadron energy loss is passing through intranuclear matter.** Strugalski, Z. (Warsaw Univ. (Poland)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HADRON REACTIONS/energy losses; HADRON REACTIONS/nuclear matter

6453 Particle Invariance Principles and Symmetries

27566 (FNAL/C–89-41-T) **Finding strongly interacting symmetry breaking at the SSC.** Golden, M. Fermi National Accelerator Lab., Batavia, IL (USA). Feb 1989. 11p. DOE Contract AC02-76CH03000. (CONF-8811175–4: Beyond the standard model, Ames, IA, US, November 18, 1988). Order Number DE89011098/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Pairs of gauge bosons, W and Z, are a probe of the electroweak symmetry-breaking sector, since the numbers of two gauge boson events are much larger in strongly coupled models than weak. The doubly charged channels W^+W^+ and $W^-W\{sup-\}$ are cleanest, since they do not suffer from $q\bar{q}X$ or gg fusion backgrounds. The like-charged gauge boson events are observable only if the symmetry breaking sector is strongly interacting. 19 refs., 4 figs., 2 tabs.

6454 Field Theory

27567 (FNAL/C–88/188-A) **String mediated phase transitions.** Copeland, E.; Haws, D.; Rivers, R.; Holbraad, S. Fermi National Accelerator Lab., Batavia, IL (USA). Nov 1988. 23p. DOE Contract AC02-76CH03000. (CONF-8810333–3: International workshop on thermal field theories and their applications, Cleveland, OH, US, October 3, 1988). Order Number DE89011097/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is demonstrated from first principles how the existence of string like structures can cause a system to undergo a phase transition. In particular, we concentrate on the role of topologically stable cosmic string in the restoration of spontaneously broken symmetries. We discuss how the thermodynamic properties of strings alter when stiffness and nearest neighbor string-string interactions are included. 25 refs., 5 figs.

27568 (INIS-BR–1424, pp. 17) **On a field theory formulation in phase space.** Santana, A.E. (Bahia Univ., Salvador (Brazil). Inst. de Fisica); Matos Neto, A.; Vianna, J.D.M.; Guedes, J. Sociedade Brasileira de Fisica, Sao Paulo, SP (Brazil). 1988. (In Portuguese). (CONF-8809300–: 9. national meeting of particle physics and fields, Caxambu, BR, September 21, 1988). In *Proceedings of the 9. National Meeting of Particle Physics and Fields.* Order Number DE88705747/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

FIELD THEORIES/phase space; ALGEBRA; BOLTZMANN-VLASOV EQUATION; LIE GROUPS

27569 (NORDITA–88/47-P-Prepr.) **N-point g-loop vertex for free bosonic theory with vacuum charge Q.** Di Vecchia, P.; Pezzella, F.; Frau, M.; Hornfeck, K.; Lerda, A.; Sciuto, S. Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark). Dec 1988. 68p. English (MIT-CTP–1674). Order Number DE88706350/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Starting from the N-Point Vertex on the sphere and using the sewing procedure we construct the N-Point g-Loop Vertex for a free bosonic theory with vacuum charge Q. We then show that, when this vertex is saturated with N highest weight states, it gives their correlation function on an arbitrary Riemann surface of genus g. We also extend our formalism to the case of a free scalar field compactified on a circle, which is related to the Coulomb gas description of minimal models.

65 PHYSICS II

6510 Nuclear Physics

Refer also to citation(s) 26525, 27594, 27598

27570 (INIS-BR–1458, pp. 4) **Internal Bremsstrahlung in electron capture and neutrino mass.** Logan, B.A. (Ottawa Univ., Ontario (Canada). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NEUTRINOS/internal bremsstrahlung; NEUTRINOS/mass; NEUTRINOS/measuring methods; ELECTRON CAPTURE; KEV RANGE 10-100; NEUTRINOS; MASS

27571 (INIS-BR–1458, pp. 97) **Real and virtual radiation.** Wolynec, E. (Sao Paulo Univ., SP (Brazil)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

VIRTUAL PARTICLES/photonuclear reactions; BREMSSTRAHLUNG; CROSS SECTIONS; DWBA; MULTIPOLES

27572 (INIS-SU–77/A, pp. 135-137) **Possibility of experimental investigation of P and T odd neutron-optical effects for neutrons of resonance energy at stationary reactor.** Kuznetsov, V.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order

Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A new method is suggested for studying P- and T-odd neutron-optical effects in the resonance energy range on a stationary reactor. The expected sensitivity to the measurement of a total cross section asymmetry for P-resonances of some nuclei is estimated. 3 refs.; 1 tab.

27573 (INIS-SU–77/A, pp. 262) **Search for parity violation in total cross section of thermal neutron interaction with intermediate mass and heavy nuclei.** Bondarenko, L.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Zhukov, S.V.; Kuznetsov, V.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

HEAVY NUCLEI/neutron reactions; INTERMEDIATE MASS NUCLEI/neutron reactions; ASYMMETRY; P INVARIANCE; TOTAL CROSS SECTIONS

27574 (INIS-SU–77/A, pp. 268-272) **Investigation of parity violation in resonance scattering of gamma quanta from neutron capture.** Beda, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Bondarenko, L.N.; Gel'tenbort, P. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

P-odd asymmetries of counting rates for neutron capture gamma rays, resonancely scattered by ^{112}Cd, ^{139}La, ^{141}Pr, ^{142}Nd, ^{205}Tl, ^{208}Pb nuclei were measured. 4 refs.; 2 figs.

27575 (INIS-SU–77/A, pp. 377-381) **Some remarks about comparison of experimental values of cross sections of fast neutron capture in a nuclear data evaluation.** Belanova, T.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

When preparing files of evaluated cross sections of neutron capture in the energy range from 1 keV to 10 MeV for structural materials and fission products a large amount of experimental data, including the data in which considerable discrepancies are observed, has been analyzed. The major part of the discrepancies falls on capture cross sections obtained by relative measurement methods, where data absolutization is realized using the so-called reference or (normalization) standard cross sections. The comparison σ (n, γ) for each isotope should be made observing the condition of similar normalization (standardization). When the analysis is not made, it often results in erroneous conclusions and recommendations. 28 refs.; 1 fig.

27576 (UKNDC–(87)P115) **UK nuclear data progress report, January–December 1987.** Sene, M.R.; Cookson, J.A. (eds.). UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div. Dec 1988. 84p. (NEANDC(E)–292-Vol.8; INDC(UK)–043/LN). Available from United Kingdom Atomic Energy Authority, Harwell Laboratory, Oxfordshire, OX11 ORA, England.

This report, summarizing nuclear data research in the United Kingdom during 1987, has been prepared at the request of the UK Nuclear Data Committee (UKNDC). Apart from work coordinated by the Chemical Nuclear Data Committee of the UKNDC, which appears under the heading of Chemical Nuclear Data, progress reports are presented by laboratory. This year there have been contributions from the UKAEA establishments at Harwell and Winfrith, from the National Physical Laboratory and from the Universities of Birmingham, Oxford and Sussex. Included in these contributions, however, are reports of work carried out by collaborations extending involvement to the following Institutions: Queen Mary College and Imperial College of the University of London, Liverpool Polytechnic, Manchester University, Culham Laboratory, JET, CEGB Berkeley Nuclear Laboratory, Dounreay Nuclear Power Establishment, AWE Aldermaston, Daresbury Laboratory, Hammersmith Hospital, the Technical University of Vienna and the Laboratoire de Spectrometrie Nucleaire, CSNSM, Orsay.

6512 Nuclear Properties and Reactions, A=1-5, Experimental

Refer also to citation(s) 27563

6515 Nuclear Properties and Reactions, A=39-58, Experimental

27577 (INIS-SU–77/A, pp. 254-257) **Energy dependence of P odd asymmetry coefficient of ^{233}U fission fragment divergence.** Aleksandrovich, A.Ya. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Val'skij, G.V.; Petrov, G.A.; Pleva, Yu.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The summary data of the ^{233}U fission fragment angular distribution P-odd asymmetry for polarized neutron energies E_n<2,5 eV have been discussed in the framework of the P-odd effect theory. As a result the p-resonance parameters and the weak interaction nuclear matrix element estimations have been obtained. 7 refs.; 2 figs.

6517 Nuclear Properties and Reactions, A=90-149, Experimental

27578 (INIS-BR–1458, pp. 45) **Absolute measurement of ^{115}In capture cross section at 144 and 565 KeV.** Ma Hongchang (Institute of Atomic Energy, Beijing (China)); Lu Hanlin; Rong Chaofan; Zhao Wenrong; Ren Peoxue; Yang Xiaoyan. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INDIUM 116/beta detection; NEUTRON REACTIONS/capture; NEUTRON REACTIONS/indium 115 target; NEUTRON REACTIONS/indium 116; COINCIDENCE METHODS; CROSS SECTIONS; KEV RANGE 100-1000; MONTE CARLO METHOD; CAPTURE; PROPORTIONAL COUNTERS

27579 (INIS-SU–77/A, pp. 102-106) **Relation between different parity nonconservation effects in capture reactions of slow neutrons.** Alfimenkov, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR)); Pikel'ner, L.B.; Sharapov, Eh.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

On the basis of experimental data on the properties of ^{113}Cd and ^{117}Sn p-wave resonances there was carried out a comparison of various effects of parity violation in these nuclei. 20 refs.; 2 tabs.

27580 (INIS-SU–77/A, pp. 249-253) **Investigation of parity nonconservation in neutron p resonances of ^{93}Nb, ^{113}Cd and ^{141}Pr nuclei.** Alfimenkov, V.P. (Joint Inst. for Nuclear Research,

Dubna (USSR)); Borzakov, S.B.; Makareev, Yu.D.; Pikel'ner, L.B.; Khrykin, A.S.; Sharapov, Eh.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Parity nonconservation effects in neutron transmission were measured on the polarized beam of resonance neutrons from the IBR-30 reactor with injector. Nuclei with known p-resonances (^{93}Nb) and with p-resonance observed in the Laboratory of Neutron Physics experiments (^{113}Cd and ^{141}Pr) were used in the measurements. The effect was not observed within the achieved experimental accuracy, the upper estimate was obtained. 7 refs.; 1 fig.

27581 (INIS-SU–77/A, pp. 262) **Investigation of space parity nonconservation effect in neutron resonances of ^{139}La and ^{117}Sn.** Biryukov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Bondarenko, L.N.; Zakharov, Yu.V. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

LANTHANUM 139/neutron reactions; NEUTRON REACTIONS/ asymmetry; TIN 117/neutron reactions; ASYMMETRY; P INVARIANCE; P STATES

27582 (INIS-SU–77/A, pp. 263-267) **Parameters of ^{111}Cd, ^{113}Cd and ^{117}Sn p wave resonances at neutron energies up to 10 eV.** Alfimenkov, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR)); Borzakov, S.B.; Mareev, Yu.D.; Pikel'ner, L.B.; Khrykin, A.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The energy dependence (E=0,025-10 eV) of the cross sections was measured for the enriched isotope targets of ^{111}Cd, ^{113}Cd and ^{117}Sn. The spins J, the widths and spin channel mixing were obtained for some p-wave resonances. The results were used for the determination of matrix elements of the weak interaction that violates parity in compound states. 9 refs.; 2 figs.; 1 tab.

6518 Nuclear Properties and Reactions, A=150-189, Experimental

27583 (INIS-BR–1458, pp. 35) **Determination of K-electron capture probabilities by using sum peaks in Ge spectra.** Singh, K. (Gujarat Univ., Ahmedabad (India). Dept. of Physics); Gill, T.S.; Kulwant Singh; Sahota, H.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

K CAPTURE/peaks; K CAPTURE/probability; K CAPTURE/ ytterbium 169; YTTERBIUM 169/k capture; YTTERBIUM 169/peaks; YTTERBIUM 169/probability; GAMMA RADIATION; PEAKS; PROBABILITY; X RADIATION

27584 (INIS-BR–1458, pp. 257) **Absolute measurement of ^{155}In capture cross section at 144 and 565 KeV.** Hongchang, M. (Institute of Atomic Energy, Beijing (China)); Haulin, L.; Chaofan, R.; Wenrong, Z.; Peixue, R.; Xiaoyun, Y. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INDIUM/integral cross sections; INDIUM/kev range 100-1000; GAMMA RADIATION; INDIUM; NEUTRON FLUENCE; NEUTRON REACTIONS; NEUTRON SOURCES; PROPORTIONAL COUNTERS; VAN DE GRAAFF ACCELERATORS

6519 Nuclear Properties and Reactions, A=190-219, Experimental

27585 (LBL–26792) **Transverse energy and multiplicity from heavy ion collisions at 200 A GeV.** Ritter, H.G.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Clewing, G.; Dragon, L. Lawrence Berkeley Lab., CA (USA). Feb 1989. 14p. DOE Contract AC03-76SF00098;AC05-84OR21400. (CONF-8810264–12: Conference on hadronic matter in collision, Tucson, AZ, US, October 6, 1988). Order Number DE89010680/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The successful acceleration of light ions at the CERN SPS and at the Brookhaven AGS opened the exciting field of ultra-relativistic heavy ion collisions for systematic studies. The first experiments were designed mainly to survey the reactions and to establish the essential features of the collisions. In this paper results from the WA80 experiment on transverse energy and charged particle multiplicity are reported. These two quantities are determined by most of the experiments and can be used to characterize the events. Large multiplicities and large transverse energies are correlated with violet collisions or with small impact parameters. In addition, an estimate of the energy density reached in the collision can be derived from those two measurements. One would like to know if the energy density necessary for the transition to the quark gluon plasma has been reached. The results of the first round of experiments with oxygen ions at 60 and 200 GeV per nucleon are collected in the proceedings of the Quark Matter 88 Conference. Some of these results are summarized here together with new results on multiplicity fluctuations.

6520 Nuclear Properties and Reactions, A=220 and Above, Experimental

27586 (BLG–592) **Spontaneous and induced fission of the plutonium isotopes.** Wagemans, C.; Schillebeeckx, P.; Deruytter, A.; Barthelemy, R. Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Nov 1986. 23Pp. (In French). Order Number DE89610088/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The main characteristics of the energy and mass distributions of the fragments emitted in the spontaneous fission of ^{236}Pu, ^{238}Pu, ^{240}Pu, ^{242}Pu and ^{244}Pu and in the thermal fission of ^{239}Pu and ^{241}Pu are discussed. The great influence of the neutron shell effects on these distributions is demonstrated and interpreted in terms of the scission-point model. The results also indicate that fission seems to be a strongly damped process, above as well as below the fission barrier. (Author). 24 refs.

27587 (CONF-890406–12) **Analysis of the ^{235}U neutron cross sections in the resolved resonance range.** Leal, L.C.; de Saussure, G.; Perez, R.B. Oak Ridge National Lab., TN (USA). 1989. 7p. DOE Contract AC05-84OR21400. From Fifty years with nuclear fission conference; Gaithersburg, MD, US; April 25, 1989. Order Number DE89010842/JAW. Available from NTIS, PC A02 - OSTI.

Using recent high-resolution measurements of the neutron transmission of ^{235}U and the spin-separated fission cross-section data of Moore et al., a multilevel analysis of the ^{235}U neutron cross sections was performed up to 300 eV. The Dyson Metha Δ_3 statistics were used to help locate small levels above 100 eV where resonances are not clearly resolved even in the best resolution measurements available. The statistical properties of the resonance parameters are discussed. 13 refs., 8 figs., 1 tab.

27588 (INIS-SU–77/A, pp. 116-120) **Measurement of P odd asymmetry of fragments divergence during ternary plutonium**

239 fission. Belozerov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Vodennikov, B.D.; Danilyan, V.G. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

An experimental data comparison of the P-odd asymmetry coefficient of fragment emission in binary and ternary fission of plutonium-239 by polarized thermal neutrons was made. The ternary to binary fission asymmetry coefficients ratio was found to be 0,73±0,20. 6 refs.; 2 figs.

27589 (INIS-SU–77/A, pp. 258-261) **P odd asymmetry in total cross section of ^{233}U at energy of longitudinally polarized neutrons in the 0.12-0.23 eV range.** Aleksandrovich, A.Ya. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Val'skij, G.V.; Petrov, G.A.; Pleva, Yu.S.; Sokolov, V.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

P-odd asymmetry coefficients in ^{233}U total cross section were measured for the four energies of longitudinally polarized neutrons in the region of mixing p-resonance existance supposed. The following upper limit for the possible effect was determined $<8\times10^{-6}$ (95% c.l.). 11 refs.; 1 fig.

27590 (UCRL–99663) **Neutron emission as a function of fragment energy in the spontaneous fission of ^{260}Md.** Wild, J.F.; van Aarle, J.; Westmeiser, W.; Lougheed, R.W.; Hulet, E.K.; Moody, K.J.; Dougan, R.J.; Brandt, R.; Patzelt, P. Lawrence Livermore National Lab., CA (USA). 19 Apr 1989. 6p. DOE Contract W-7405-ENG-48. (CONF-890406–10: Fifty years with nuclear fission conference, Gaithersburg, MD, US, April 25, 1989). Order Number DE89010783/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have made the first measurement of the number of neutrons emitted in the spontaneous fission of a nuclide in which very high fragment energies dominate the fission process. In bombardments of ^{254}Es, we produced 28-d ^{260}Md, which was neutron-counted in a 1-m-diam spherical tank containing a Gd-doped scintillator solution. The average number of neutrons emitted per fission is only 2.58 ± 0.11, substantially less than for other actinides. A direct correlation of neutron multiplicity with fragment excitation energy is clearly demonstrated. 3 refs., 5 figs.

27591 (UCRL–99676) **An instrument for determining spontaneous-fission properties of millisecond isotopes.** Dougan, R.J.; Baisden, P.A.; Hulet, E.K. Lawrence Livermore National Lab., CA (USA). 19 Apr 1989. 5p. DOE Contract W-7405-ENG-48. (CONF-890406–11: Fifty years with nuclear fission conference, Gaithersburg, MD, US, April 25, 1989). Order Number DE89010784/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have developed a spinning wheel analyzer of millisecond isotopes (SWAMI), an instrument to measure the kinetic energy of fission- fragment pairs from the spontaneous fission (SF) of millisecond isotopes. This instrument employs a continuous band of thin, aluminum foils mounted at the perimeter of a spinning wheel to stop and retain recoil products produced during continuous, heavy-ion bombardment of heavy, actinide targets. The rotation of the wheel moves the implanted reaction products past four pairs of surface-barrier detectors, where the energies of correlated fission fragments are measured. With this instrument, we can determine the mass and total kinetic energy (TKE) distributions for isotopes with half-lives between 0.5 and 300 ms. To date, we have used SWAMI to measure the mass and TKE distributions for two nuclides, 20-ms ^{260}[104] and 1.2-ms ^{258}No. 4 refs., 1 fig.

27592 (UCRL–99678) **Bimodal fission.** Hulet, E.K. Lawrence Livermore National Lab., CA (USA). 19 Apr 1989. 10p. DOE Contract W-7405-ENG-48. (CONF-890406–9: Fifty years with nuclear fission conference, Gaithersburg, MD, US, April 25, 1989). Order Number DE89010782/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In recent years, we have measured the mass and kinetic-energy distributions from the spontaneous fission of ^{258}Fm, ^{259}Md, ^{260}Md, ^{258}No, ^{262}No, and ^{260}[104]. All are observed to fission with a symmetrical division of mass, whereas the total-kinetic-energy (TKE) distributions strongly deviated from the Gaussian shape characteristically found in the fission of all other actinides. When the TKE distributions are resolved into two Gaussians the constituent peaks lie near 200 and near 233 MeV. We conclude two modes or bimodal fission is occurring in five of the six nuclides studied. Both modes are possible in the same nuclides, but one generally predominates. We also conclude the low-energy but mass-symmetrical mode is likely to extend to far heavier nuclei; while the high-energy mode will be restricted to a smaller region, a region of nuclei defined by the proximity of the fragments to the strong neutron and proton shells in ^{132}Sn. 16 refs., 7 figs., 1 tab.

6530 Nuclear Theory

27593 (DOE/ER/40461–1) **Theoretical nuclear reaction and structure studies using hyperons and photons: Progress report, January–December 1988.** Cotanch, S.R. North Carolina State Univ., Raleigh, NC (USA). Dept. of Physics. Mar 1989. 7p. DOE Contract FG05-88ER40461. Order Number DE89010619/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report briefly discusses the following topics on strangeness electromagnetic production: production from the proton and deuteron and production of hypernuclei. 3 refs.

27594 (INIS-BR–1458, pp. 1) **Effects of nuclear energy decays on the atomic electron rearrangements.** Isozumi, Y. (Kyoto Univ. (Japan). Radioisotope Research Center). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BETA DECAY/autoionization; BETA DECAY/internal ionization; ELECTRON CAPTURE DECAY/autoionization; ELECTRON CAPTURE DECAY/internal ionization; INTERNAL CONVERSION/autoionization; INTERNAL CONVERSION/internal ionization; AUTOIONIZATION; K SHELL; MATRIX ELEMENTS; PERTURBATION THEORY

27595 (INIS-BR–1458, pp. 125) **Effect of parity nonconservation in alpha radiation from polarized actinide nuclei.** Gurevich, G.M. (AN SSSR, Moscow); Lobov, G.A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ACTINIDE NUCLEI/alpha particles; ACTINIDE NUCLEI/oriented nuclei; ACTINIDE NUCLEI/parity; ALPHA PARTICLES/actinide nuclei; PARITY; MATRIX ELEMENTS; NILSSON-MOTTELSON MODEL; SINGLE-PARTICLE MODES; WAVE FUNCTIONS

27596 (INIS-BR–1458, pp. 126) **Measurement and analysis of excitation functions for some alpha induced reactions.** Bhardwaj, H.D. (Aligarh Muslim Univ. (India)); Prasad, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALPHA REACTIONS/excitation functions; ANTIMONY 121 TARGET; ANTIMONY 123 TARGET; COBALT 59 TARGET; COPPER 63 TARGET; COPPER 65 TARGET; GOLD 197 TARGET; MATRIX ELEMENTS; MEV RANGE 10-100; NIOBIUM 93 TARGET

27597 (INIS-SU–77/A, pp. 8-22) **On some problems of nuclear reactions with neutrons.** Barabanov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Belyaev, S.T. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Selected questions related to the search for end analysis of nonstatistical effects in neutron-nucleus resonance interaction are considered. Parity nonconservation effects and possible time reversal invariance violation are discussed. 46 refs.

27598 (INIS-SU–77/A, pp. 81-94) **Violation of space parity in nuclear reactions with polarized neutrons.** Krupchitskij, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Reactions of radiation capture, reactions with the escape of light particles, reactions of heavy nuclei fission and neutron-optical phenomena on polarized neutrons, are investigated. General features characteristic of the above-mentioned reactions, such as: asymmetry of the reaction secondary product escape as to spin direction of polarized neutrons, dynamic and kinematic mechanisms of nucleon-nucleon weak interaction intensification, resulting in a considerable increase in the value of seeding weak interaction, and the mechanism of opposite parity state mixing at the stage of compound nuclei, have been considered. It is pointed out that the latter mechanism is the determining one. 36 refs.; 2 tabs.

27599 (INIS-SU–77/A, pp. 127-129) **P odd effects in processes of binary and ternary fission by neutrons.** Bunakov, V.E. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Gudkov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The possibility of obtaining data on transition states in nuclear fission and on ternary fission mechanism is considered in investigating different P-violation effects. P odd asymmetry of fission fragment escape in binary fission is related with the same asymmetry in ternary fission by a proportion. 7 refs.

27600 (INIS-SU–77/A, pp. 107-111) **Time parity nonconservation in neutron interaction with oriented nuclei.** Barabanov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A t-odd but P-even correlation between the neutron spin, the target nucleus spin, and the neutron momentum in the amplitude of the elastic scattering of p-neutrons is treated. Various ways to observe experimentally the correlation are analyzed. 16 refs.

27601 (INIS-SU–77/A, pp. 299) **On a possibility of experimental investigation of partial neutron amplitude correlation in reactions with oriented nuclei.** Barabanov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

ORIENTED NUCLEI/neutron reactions; AMPLITUDES; CORRELATIONS; PARTIAL WAVES; POLARIZED BEAMS; TOTAL CROSS SECTIONS

27602 (INIS-SU–77/A, pp. 353-366) **Approximation by rational functions as processing method, analysis and transformation of neutron data.** Gaj, E.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Badikov, S.A.; Gusejnov, M.A.; Rabotnov, N.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Possible applications of rational functions in the analysis of neutron cross sections, angular distributions and neutron constants generation are described. Results of investigations made in this direction, which have been obtained after the preceding conference in Kiev, are presented: the method of simultaneous treatment of several cross sections for one compound nucleus in the resonance range; the use of the Pade approximation for elastically scattered neutron angular distribution approximation; obtaining of subgroup constants on the basis of rational approximation of cross section functional dependence on dilution cross section; the first experience in function approximation by two variables. 6 refs.; 4 figs.

27603 (INIS-SU–77/A, pp. 367-371) **On an accuracy of calculation in the weak absorption approximation. 2. Optical model and strength functions.** Korennoj, V.P. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki); Ulanovskij, A.V.; Fokov, Yu.G.; Khatkevich, O.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Sources of probable errors in strength function calculations in the framework of optical model is discussed. It is shown that for intermediate mass nuclei (A~50) conventional linear relation between penetration coefficients and strength functions resulted in considerable uncertainties. 11 refs.; 3 figs.

27604 (INIS-SU–77/A, pp. 382-386) **Subgroup parametrization of cross section structure of main fuel materials in the region of unresolved resonances.** Dolgov, E.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Koshcheev, V.N.; Sinitsa, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Using the two-subgroup parametrization with temperature-independent parts of the subgroups, the resonance structure of the cross sections in the range of nonresolved resonances for the main fuel materials, such as ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu and ^{241}Pu, is described. 5 refs.; 1 fig.

27605 (INIS-SU–77/A, pp. 387-392) **Multigroup absorption cross sections of ^{147}Sm and ^{149}Sm fission products.** Abagyan, L.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Zakharova, S.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR,

Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The capture cross sections of isotopes ^{147}Sm and ^{149}Sm have been evaluated in energy range 10^{-5} eV - 10 MeV for preparing of 80-,21- and 26 group cross sections and involving them into the fission product capture cross section library for reactor calculation. The evaluation is based on the experimental data on neutron cross sections of these isotopes, reported until the 1986 year, and available evaluations of other authors. 11 refs.; 4 figs.

27606 (INIS-SU–77/A, pp. 393-399) **Consistent evaluation of neutron cross sections of $^{246-248}$Cm isotopes.** Maslov, V.M. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

To calculate $^{246+248}$Cm fission and (n,xn) reactions cross sections, the results of U,Pu,Am nuclei neutron data analysis are employed. Available evaluations are compared with obtained results. The results of theoretical calculations of neutron cross sections point to unsatisfactory character of the major part of evaluations, which were introduced in neutron data files INDL/A. The results of the given work can be the basis for practical reassessment of files for Cm isotopes and development of recommendations on the use of the known assessments. 9 refs.; 4 figs.

27607 (INIS-SU–77/A, pp. 400-403) **On calculation of transmission function, self-indication and blocking neutron cross section for isotope mixture according to data of ENDF/B files.** Vertesh, P. (Joint Inst. for Nuclear Research, Dubna (USSR)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Formulae and algorithm for the calculation of transmission self-indication and blocking cross-sections of isotope mixtures are presented. Problems arising from the application of ENDF/B data are discussed and a change in the procedures for the unresolved region is recommended. 9 refs.; 2 tabs.

27608 (INIS-SU–77/A, pp. 409-412) **Estimation of ^{241}Pu neutron constants in the 0.1-30 keV energy range.** Koyumdzhieva, N. (Bylgarska Akademiya na Naukite, Sofia (Bulgaria). Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Savova, N.; Toshkov, S.; Yaneva, N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

^{241}Pu neutron constants have been calculated in the region of unresolved resonances. The improved method of averaged neutron cross sections modelling has been used. The resonance levels interference and resonance parameters fluctuations are taken into account. The comparison with other evaluation is presented. 3 refs.; 2 figs.; 2 tabs.

27609 (INIS-SU–77/A, pp. 413-417) **Calculation of spectra of secondary neutrons consecutively emitted in the (n,n'),(n,2n),(n,3n),(n,n'f),(n,2nf),(n,3nf) reactions.** Maslov, V.M. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki); Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A simple methodology to calculate spectra of secondary neutrons emitted in the cascades during (n,n'),(n,2n),(n,3n),(n,n'f),(n,2nf) and (n,3nf) reactions is presented. The calculated spectra of secondary neutrons of possible reactions for ^{235}U nucleus at the energy of incident neutrons 8 and 14 MeV are presented. The shape of the spectra differs considerably from the Maxwellian distribution even for the second and third neutron emitted from equilibrium nucleus. 6 refs.; 3 figs.

27610 (INIS-SU–77/A, pp. 418-422) **Cross sections of γ activation using neutrons with energy of 0.025eV-15MeV for 12 elements.** Vasil'ev, A.P.; Kozmanova, L.G.; Lyutov, V.D.; Cherepanova, E.I.; Shmakov, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Cross sections of gamma-activation for 12 elements constituted construction materials are presented. 28 - group cross sections of 45 reactions on 26 isotopes are given in the report. Discrepancy between measured and calculated ^{235}U fission spectrum averaged cross sections were found for several reactions. 11 refs.; 2 tabs.

27611 (INIS-SU–77/A, pp. 428-432) **Estimation of neutron cross sections and spectra for ^{90}Zr in the energy range from 10^{-5}eV to 20MeV.** Bychkova, V.V.; Grudzevich, O.T.; Zelenetskij, A.V.; Plyaskin, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

In the framework of creation of the soviet library of recommended evaluated neutron data, neutron cross sections of ^{90}Zr isotope have been evaluated. Total cross section, cross section of elastic and inelastic scattering, neutron capture and threshold reactions (n,p), (n,α), (n,2n), (n,np), (n,pn), angular and energy distributions of secondary neutrons, are evaluated. 15 refs.

27612 (INIS-SU–77/A, pp. 439) **On the accuracy of calculation of average neutron cross sections within weak absorption approximation.** Korennoj, V.P. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki); Ulanovskij, A.V.; Fokov, Yu.G.; Khatkevich, O.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

NEUTRON REACTIONS/cross sections; NICKEL 60 TARGET/neutron reactions; S MATRIX

27613 (INIS-SU–77/A, pp. 440) **Accumulation of ^{232}U isotope in the $^{233-235}$U(n,xn) reactions.** Maslov, V.M. (AN Belorusskoj SSR, Minsk (Byelorussian SSR). Inst. Yadernoj Ehnergetiki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

NEUTRON REACTIONS/nuclear reaction yield; URANIUM 232; URANIUM 233 TARGET/neutron reactions; URANIUM 234 TARGET/neutron reactions; URANIUM 235 TARGET/neutron reactions; CROSS SECTIONS; NEUTRONS

27614 (INIS-SU–77/A, pp. 433-437) **Estimation of average resonance parameters according to data for resolved resonances.** Korchagina, Zh.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Manturov, G.N.; Nikolaev, M.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Using as an example ^{52}Cr nucleus, the problem of resonance parameter evaluation is discussed. The method of evaluation is based on the probability consideration of resonance belonging to one or another system of levels. The approach applied to the evaluation of average parameters is characterized by a higher obviousness than the formalized methods of statistical analysis. 8 refs.; 2 figs.

27615 (INIS-SU–77/A, pp. 438) **Testing the methods and programs for calculation of cross sections and self-shielding factors in unresolved resonance range.** Koshcheev, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Krivtsov, A.S.; Sinitsa, V.V.; Ukraintsev, V.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

PLUTONIUM 239/resonance integrals; URANIUM 238/resonance integrals; F CODES; FORBIDDEN TRANSITIONS; G CODES; M CODES; N CODES; PERFORMANCE TESTING; SELF-SHIELDING

27616 (INIS-SU–77/A, pp. 440) **Method for evaluation of cross sections and their resonance structure in unresolved resonance range.** Manturov, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Nikolaev, M.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

NUCLEAR DATA COLLECTIONS/e codes; FORBIDDEN TRANSITIONS; RESONANCE INTEGRALS

6540 Radiation and Shielding Physics

Refer also to citation(s) 27022, 27028, 27031, 27032, 27033, 27034, 27035, 27036, 27037, 27038, 27701, 27702

27617 (INIS-BR–1458) **Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.** Sao Paulo Univ., SP (Brazil). 1988. 277p. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

The studies on: fundamental processes in radiation physics; radiation sources and detectors; physical, chemical and biological radiation effects; plasma technology; radioisotope application in medicine and agriculture; environment; use of radiation in material science and; reactor technology, are presented. (M.C.K.).

27618 (INIS-BR–1458, pp. 24) **Range and stopping power for slowing down of particles in matter.** Molinari, V. (Bologna Univ. (Italy)); Trombetti, T. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRONS/elastic scattering; ELECTRONS/range; ELECTRONS/stopping power; NEUTRONS/cross sections; NEUTRONS/elastic scattering; NEUTRONS/slowing-down; DISTRIBUTION FUNCTIONS; ELECTRONS; RANGE; NEUTRONS; SLOWING-DOWN; PENETRATION DEPTH; TRANSPORT THEORY

27619 (INIS-BR–1458, pp. 62) **Evaluation of neutron thermalization parameters and benchmark reactor calculations using a synthetic scattering function for molecular gases.** Gillette, V.H. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche); Patino, N.E.; Granada, J.R.; Mayer, R.E. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MOLECULE COLLISIONS/gases; MOLECULE COLLISIONS/neutrons; NEUTRONS/incoherent scattering; NEUTRONS/thermalization; BENCHMARKS; KERNELS; GASES; NEUTRONS; THERMALIZATION; TOTAL CROSS SECTIONS

27620 (INIS-BR–1458, pp. 86) **Multiple scattering resonance self-shielding factors in foils.** Lopes, M.C. (LNETI, Scavem (Portugal). Inst. of Nuclear Sciences and Engineering); Avila, J.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MULTIPLE SCATTERING/foils; MULTIPLE SCATTERING/self-shielding; MULTIPLE SCATTERING/thermal neutrons; CROSS SECTIONS; ENERGY DEPENDENCE; INTEGRAL EQUATIONS; FOILS; SELF-SHIELDING; PROBES

27621 (INIS-BR–1458, pp. 12) **Effect of the X-ray scattering anisotropy on the diffusion of photons in the frame of the transport theory.** Fernandez, J.E. (Bologna Univ. (Italy)); Molinari, V.G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BACKSCATTERING/anisotropy; BACKSCATTERING/photon transport; BACKSCATTERING/transport theory; X-RAY DIFFRACTION/photon transport; X-RAY DIFFRACTION/transport theory; BACKSCATTERING; ANISOTROPY; BOUNDARY CONDITIONS; CROSS SECTIONS; INELASTIC SCATTERING

27622 (INIS-BR–1458, pp. 28) **Multigroup flux-limited asymptotic diffusion Fokker-Planck equation.** Cheng-an, L. (Institute of Applied Physics and Computational Mathematics, Beijing (China)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIATION TRANSPORT/diffusion; RADIATION TRANSPORT/fokker-planck equation; RADIATION TRANSPORT/multigroup theory; BOUNDARY CONDITIONS; DIFFUSION

27623 (INIS-BR–1458, pp. 94) **Inelastic x-ray scattering.** Schuelke, W. (Dortmund Univ. (Germany, F.R.). Inst. fuer Physik). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

INELASTIC SCATTERING/synchrotron radiation; INELASTIC SCATTERING/x-ray spectroscopy

27624 (INIS-BR–1458, pp. 118) **New method for the direct measurement of the energy absorption coefficient of gamma-rays.** Bradley, D.A. (Sains Malysia Univ., Pulan Pinang (Malaysia). School of Physics); Chong, C.S.; Shukri, A.; Tajuddin, A.A.; Ghose, A.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October

3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/absorption; GAMMA RADIATION/measuring methods; EXPERIMENTAL DATA; EXTRAPOLATION; ABSORPTION; PARAFFIN; PROPORTIONAL COUNTERS

27625 (INIS-BR–1458, pp. 224) **Measurement of energy albedo for backscattered gamma rays for composite layers of concrete.** Bhattacharjee, A. (Regional Engineering Coll., Silchar (India)); Sinha, A.K. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALBEDO/backscattering; ALBEDO/concretes; ALBEDO/gamma radiation; CONCRETES/gamma radiation; CONCRETES/shielding materials; ALBEDO; BACKSCATTERING; CONCRETES; ALUMINIUM; COMPOSITE MATERIALS; IRON; LAYERS; SCINTILLATION COUNTERS

27626 (INIS-BR–1458, pp. 225) **Number albedo measurements for backscattered photons from stratified layers of iron, concrete and aluminium.** Sinha, A.K. (Regional Engineering Coll., Silchar (India)); Bhattacharjee, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM/layers; ALUMINIUM/shielding materials; CONCRETES/albedo; CONCRETES/layers; CONCRETES/shielding materials, IRON/layers; IRON/shielding materials; SHIELDING MATERIALS/gamma radiation; ALUMINIUM; LAYERS; ANGULAR DISTRIBUTION; BACKSCATTERING; CONCRETES; ALBEDO; IRON; KEV RANGE 100-1000; PHOTON BEAMS

27627 (INIS-BR–1458, pp. 227) **ANSI standard data buildup factors - the Indian contribution.** Gopinath, D.V. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Subbiah, K.V.; Trubey, D.K. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/buildup; GAMMA RADIATION/materials; GAMMA RADIATION/standardization; A CODES; ANNIHILATION; BREMSSTRAHLUNG; COMPUTER CALCULATIONS; FLUORESCENCE; BUILDUP; MATERIALS; STANDARDIZATION; INDIA

27628 (INIS-BR–1458, pp. 255) **Low-energy gamma-ray albedo.** Panin, M.P. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)); Panchenko, A.M.; Barashev, A.V. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/albedo; BACKSCATTERING; ALBEDO; KEV RANGE 10-100; KEV RANGE 100-1000; MONTE CARLO METHOD; POINT SOURCES

27629 (INIS-BR–1458, pp. 267) **Measurements on Rayleigh scattering and comparison with form factor theories 60KeV <=E<=600KeV.** Goncalves, O.D. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Fisica); Barros, S. de; Eichler, J.P.F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RAYLEIGH SCATTERING/cross sections; RAYLEIGH SCATTERING/form factors; ANGULAR DISTRIBUTION; COMPARATIVE EVALUATIONS; GAMMA RADIATION; KEV RANGE 10-100; KEV RANGE 100-1000; MATHEMATICAL MODELS; MOMENTUM TRANSFER

27630 (INIS-SU–77/A) **Neutron physics. Vol. 1.** Kuz'minov, B.D. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 450p. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Individual papers in these proceedings are indexed separately.

27631 (INIS-SU–77/A, pp. 50-55) **Search for the electric dipole moment of the neutron.** Altarev, I.S. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Borisov, Yu.V.; Borovikova, N.V. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The result of the measurement of the electric dipole moment of the neutron by storage of the ultracold neutrons (d_n=-(1,4±0,6)x10^{-25} excm) (EDM) is presented. It is interpreted as a new upper limit on the neutron EDM d_n<2,6x10^{-25} excm at 95% confidence level. 3 refs.; 1 tab.

27632 (INIS-SU–77/A, pp. 60-67) **Measurement of gravity force acceleration of free-falling neutrons in the 0.4223-0.0175 eV energy range.** Grigor'ev, Yu.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Gravity acceleration of free-falling neutrons has been measured on gravitational spectrometer of the pulsed fast reactor IBR-30 in Dubna. The experimental acceleration is 980,1±1,3cm/c^2, that is 0,14% less them the calculated local value. 4 refs.; 3 tabs.

27633 (INIS-SU–77/A, pp. 68-75) **Neutron monochromator with five synchronous rotating rotors suspended in magnetic field intended for measurement of free neutron lifetime.** Kalebin, S.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Rukolajne, G.V.; Polozov, A.N.; Artamonov, V.S.; Ivanov, R.N.; Chernyshov, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The paper gives schematic representation of the experiment and describes the neutron monochromator. The rotors are driven at speeds up to 15000 rpm, phase instability between them is smaller than 0,25 μs. The monochromator produces neutron pulses having wavelengths up to 0,3 nm and resolution 2,8%. Background value between neutron pulses is about 0,01% for neutron wavelengths 0,3 - 0,4 nm. 9 refs.; 6 figs.

27634 (INIS-SU–77/A, pp. 76-80) **Determination of the neutron mass and implications for fundamental constants.** Greene, G.L. (National Bureau of Standards, Gaithersburg, MD (USA)); Kessler, J.; Dewey, M.S.; Deslattes, R.D.; Borner, H. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. English (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order

Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

A review of the current experimental status of the neutron mass is given along with a discussion of the prospects for improvement in the near future. The most accurate method for the determination of the neutron mass relies on two independent measurements. In the first, the deuteron binding energy is determined by measuring the energy of the =2.2 MeV gamma ray from the reaction n+p->d+γ. For thermal neutron capture on protons in a static target, the gamma energy is equal to the deuteron binding energy (less a well understood correction for the deuteron recoil). In th second, independent step the difference in mass between two hydrogen atoms and one deuterium atom is determined. This mass doublet 2^1H-D is determined, ultimately, by measuring th cyclotron frequency difference for appropriate ions of the two hydrogen isotopes. The implication of these results for the fundamental constants as well as for tests of QED is briefly reviewed. 13 refs.

27635 (INIS-SU–77/A, pp. 95-99) **Space spin resonance of polarized neutrons.** Agamalyan, M.M. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Drabkin, G.M.; Sbitnev, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Investigations of space spin resonance (SSR) are carried out by means of magnetic monochromator. SSR presents the phenomenon of a selective spin flip with respect to the speed of neutron transfer across a system of two perpendicular magnetic fields one of which periodically reverses its sign in the space along neutron movement. 10 refs.; 4 figs.

27636 (INIS-SU–77/A, pp. 112-115) **On a possible parity nonconservation in ultracold neutron interaction with matter.** Barabanov, A.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Various ways to observe spatial parity nonconservation effects in resonance potential interactions of ultracold neutrons with matter are treated. 8 refs.

27637 (INIS-SU–77/A, pp. 176-179) **Neutron scattering by crystal in a field of intensive electromagnetic wave.** Dzyublik, A.Ya. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Theory is presented for the scattering of neutrons by a crystal affected by the radio-frequency field or laser wave.

27638 (INIS-SU–77/A, pp. 190-192) **Upscattering of ultracold neutrons (UCN) by excitations in superfluid helium.** Golub, R. (Technische Univ. Berlin (Germany, F.R.)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. English (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The measurements of the temperature dependence of the Ultracold Neutrons (UCN) time were made in Helium filled UCN storage chamber. The results are in reasonable agreement with calculations. 3 refs.

27639 (INIS-SU–77/A, pp. 193-197) **Long-duration storage of neutrons in simply connected gravimagnetic trap.** Abov, Yu.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Vasil'ev, V.V.; Vladimirskij, V.V.; Rozhnin, I.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The experiment on a magnetic storage of ultracold neutrons in a simply connected confining trap is done. It is found that the energy range of trapped neutrons is wider than the spectral range provided by the magnetic field. It is shown that the storage time for magnetic range neutrons is above 700 s. 4 refs.; 2 figs.

27640 (INIS-SU–77/A, pp. 198-203) **Gaskinetics of ultracold neutrons.** Morozov, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Panin, Yu.N.; Rogov, E.V.; Fomin, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The distribution of ultracold neutron gas (UCN) density in vertical and horizontal neutron guides is studied experimentally. The measurements with the horizontal guide were made to test the possibility of diffuse approximation use for the description of UCN gas current over the neutron guides. The measurements with the vertical neutron guide were made for direct determination of the function, describing neutron gas distribution in the gravitational field. 5 refs.; 4 figs.

27641 (INIS-SU–77/A, pp. 204-206) **On anomaly in spectrum of ultracold neutrons extracted from zirconium hydride converter.** Terekhov, G.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The spectra of the ultracold neutrons extracted out from the SM-2 reactor core by means of the neutron guide tube with the zirconium hydride converter have been investigated. Some changes in the ultracold neutron spectra resulted from radiation knocking hydrogen out of zirconium hydride over 3.5 years have been observed. 3 refs.; 1 fig.

27642 (INIS-SU–77/A, pp. 207-215) **New possibilities in investigation of magnetic films by means of ultracold neutrons.** Taran, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Theoretical consideration is given to the transmission of ultracold neutrons (UCN) through ferromagnetic films. A possibility is demonstrated to derive new information about spin dependence of the UCN - magnetic film interaction from experiments on UCN multitransmission. Two versions of the apparatus on the basis of UCN traps are proposed to measure repeated transmission through one and the same film. Under analysis is the process of UCN flow from one trap into th other through a mirror neutron guide. There is shown a possibility of storing a considerable part of the initial UCN

flux. A combination of the UCN flow and storage modes in one apparatus is considered to show good prospects for the future study of thin magnetic films. 8 refs.; 4 figs.

27643 (INIS-SU–77/A, pp. 221-225) **Uktracold neutron production in gas converters.** Kaipov, D.K. (AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Yadernoj Fiziki); Kadykenov, M.M.; Kadykenova, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Production of ultracold neutrons (UCN) is considered in the process of slowdown of reactor thermal neutrons on gas molecules of hydrogen, deuterium, tritium, nitrogen, oxygen against pressure and temperature of gas. It has been shown that UCN is produced mainly in the result of elastic scattering. 4 refs.; 5 figs.

27644 (INIS-SU–77/A, pp. 231-234) **Measurement of the neutron lifetime by the method of UCN storing in a vessel with walls made of heavy-water ice.** Kosvintsev, Yu.Yu. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)); Terekhov, G.I.; Morozov, V.I.; Panin, Yu.N.; Rogov, E.V.; Fomin, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Measurements of the neutron lifetime were performed by using the method of storing of UCN in a vessel with walls made of heavy-water ice. A preliminary result of the measurements amounted to 893 ± 20 s. 3 refs.; 2 figs.

27645 (INIS-SU–77/A, pp. 235-239) **Spectrometric investigations in the 10^{-6}-10^{-5}eV energy range by cold neutron spectrometer.** Antonov, A.V. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Isakov, A.I.; Kuznetsov, S.P.; Meshkov, I.V.; Perekrestenko, A.D.; Shelagin, A.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The work dwells on the study of interaction of very cold neutrons (VCN) with U, ^{235}U, Pb, SiO_2, SiB_x (x=0.0006), Pd, PdH_x (x=0; 0.008; 0.105; 0.26; 0.32; 0.51; 0.71). The main processes of VCN interaction with a substance in condensed state are as follows: nuclear capture, inelastic phonon scattering, elastic scattering on nuclear potential fluctuations, as well as noncoherent scattering on hydrogen in case of PdH_x. Dependences of total cross sections of interaction $\sigma_t(V)$ or $\Sigma_t(V)$ were measured by neutron transmission through the sample in VCN spectrometer in the range of rates V<100m/s with the resolution ~ 8% according to the time-of-flight technique. The contribution of inelastic scattering was determined according to the difference of measurements for samples at room and cryogenic temperatures. According to the section, on which σ_t ~ 1/V by means of extrapolation to thermal range at V=2200m/s the σ_t^{2200} cross section was determined, as compared with table data on nuclear capture σ_c. 9 refs.; 2 figs.

27646 (INIS-SU–77/A, pp. 240-243) **Some optical phenomena in interaction of very cold neutrons with static magnetic field.** Kamchatnov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Nosov, V.G.; Frank, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Some polarization phenomena in the refraction of very cold neutrons at the boundary of a region with a homogeneous or sign-variable magnetic field, as well as in a substance positioned in the magnetic field, are considered. Specific effects caused by the difference in the value of wave numbers in two spin components of integrated stationary state are analyzed. The character of the effects depends greatly on concrete conditions. It is assumed that very cold neutrons - are neutrons, the energy of which are somewhat higher than potential barrier of the substance, or magnetic barrier; the interaction with it is being considered. 7 refs.

27647 (INIS-SU–77/A, pp. 244-248) **Study of possibility of ultracold neutron application for measurement of neutron electric charge.** Borisov, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR)); Vasil'ev, A.V.; Ivanov, S.N. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The purpose of this experiment is to investigate the possibility of the neutron electric charge measurement by means of ultracold neutrons. The experimental device based on the focusing of ultracold neutrons beam by means of a cylindrical mirror is described. The trial measurements carried out during 3 days permitted to obtain the result for $g_n=(-4.3 \pm 7.1)\times10^{-20}\ q_e$. 9 refs.; 4 figs.

27648 (INIS-SU–77/A, pp. 273) **Axial-symmetric magnetic lens for ultracold neutrons.** Terekhov, G.I. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

LENSES/ultracold neutrons; ULTRACOLD NEUTRONS/magnetic fields; LENSES; NEUTRON BEAMS; NEUTRON TRANSPORT; SOLENOIDS

27649 (INIS-SU–77/A, pp. 274-279) **Ultracold neutron reflection from powdery materials.** Golikov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR)); Kulagin, E.N.; Nikitenko, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Diffusion of ultracold neutrons (UCN) in powders has been observed and studied. Under special conditions of the annealing of powders from weakly absorbing materials (copper, copper oxide, graphite) the authors managed to reach for the first time the agreement of experimental data on the probability of UCN loss per a collision with those calculated with the help of the known capture cross sections and neutron inelastic scattering cross sections. 6 refs.; 1 tab.

27650 (INIS-SU–77/A, pp. 285-289) **Cold neutron scattering on rough interface of media.** Antonov, A.V. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Zhitnik, I.A.; Isakov, A.I. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Scattering of neutrons with λ=1nm on surface with small roughness has been investigated for the first time. The conclusion about the decisive role of surface but not the bulk has been made. A

possibility of investigation of covered surfaces and of magnetic scattering has been shown. 6 refs.; 2 figs.

27651 (INIS-SU–77/A, pp. 290-293) **Multilayer interference structures (MIS) and their application in spectrometry of long-wave neutrons.** Antonov, A.V. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Borisova, S.S.; Galanov, N.V. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Properties of multilayer interference structures (MIS) and the possibility of their application on neutron spectrometry are discussed. Analysis of MIS spectral characteristic dependence on structure parameters is carried out, MIS on the basis of different materials couples (^{58}Ni-^{62}Ni,Be-Ti, C-Ti, Ni-Ti and some others) are produced and studied, investigations of monochromators on their basis are made. The results obtained testify to the possibility of MIS production and use for spectrometric studies with long-wave neutrons. 15 refs.; 1 fig.

27652 (INIS-SU–77/A, pp. 300-304) **Multigroup library of photon yield in neutron inelastic interactions with nuclei of structural and shielding materials.** Dubinin, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Kolesov, V.E.; Krivtsov, A.S.; Svirin, M.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The design principles of BVF multigroup constant library (49 neutron + 15 photon groups) are considered. The library is to be used to calculate the secondary gamma radiation sources in nuclear facilities. 2 refs.

27653 (LA-UR–89-1402) **Equivalent-spherical-shield neutron dose calculations.** Russell, G.J.; Robinson, H. Los Alamos National Lab., NM (USA). 1988. 6p. DOE Contract W-7405-ENG-36. (CONF-8810182–25: International collaboration on advanced neutron sources (ICANS), Los Alamos, NM, US, October 3, 1988). Order Number DE89011170/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Neutron doses through 162-cm-thick spherical shields were calculated to be 1090 and 448 mrem/h for regular and magnetite concrete, respectively. These results bracket the measured data, for reinforced regular concrete, of ~600 mrem/h. The calculated fraction of the high-energy (>20 MeV) dose component also bracketed the experimental data. The measured and calculated doses were for a graphite beam stop bombarded with 100 nA of 800-MeV protons. 6 refs., 2 figs., 1 tab.

27654 The application of deep level transient spectroscopy to the measurement of radiation-induced interface state spectra. Barnes, C. (The Aerospace Corp., Los Angeles, CA (US)); Zietlow, T.; Nakamura, K. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1197-1202 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The authors have employed the technique of constant capacitance, deep level transient spectroscopy (CC-DLTS) to measure the energy distribution of the Co-60-induced interface state concentration, D_{it}, in MOS capacitors fabricated in both P and N type Si. In the Sandia baseline and Mod B test chips examined, D_{it} depends on the bias during irradiation, and on the post-irradiation anneal. Annealing at 80^{0}C alters the energy spectrum with the growth of deep states centered near 0.4 eV below the conduction band in N type samples. In contrast, for P type Si, the postanneal spectrum is dominated by shallow interface states.

27655 Donor/acceptor nature of radiation-induced interface traps. McWhorter, P.J. (Sandia National Labs., Albuquerque, NM (US)); Winokur, P.S.; Pastorek, R.A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1154-1159 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The conductance technique is used to study radiation induced interface traps on Sandia Laboratories' radiation hardened technologies. The conductance technique is used to study density of interface traps, the time constant for interface trap response, and the donor/acceptor nature of the interface traps. Donor/acceptor nature of interfaced traps is determined by comparing the theoretical and experimental values of the variance in the conductance peak. Results indicate the presence of both donor and acceptor interface traps in both parts of the bandgap post-irradiation.

27656 Comparison of enhanced device response and predicted x-ray dose enhancement effects on MOS oxides. Fleetwood, D.M. (Sandia National Labs., Albuquerque, NM (US)); Beutler, D.E.; Lorence, L.J. Jr.; Draper, B.L.; Brown, D.B.; Riewe, L.C.; Rosenstock, H.B.; Knott, D.P. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1265-1271 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The response of MOS capacitors to low- and medium-energy x-ray irradiation is investigated as a function of gate material (TaSi or Al), oxide thickness, and electric field. Measured device response is compared with predictions based on discrete ordinates and Monte Carlo code simulations of dose enhancement effects, coupled with recent estimates of electron-hole recombination in MOS oxides. In comparisons of 10-keV x-ray and Co-60 irradiations of Al-gate MOS capacitors at an oxide electric field of 1 MV/cm, it is found that predictions and experiments agree to within better than 20 percent for oxide thicknesses ranging from 35 to 1060 nm. For capacitors having TaSi/Al gates, predictions and experiments agree to within better than 30 percent at 1 MV/cm, with the largest differences occurring for 35-nm gate oxides. At other electric fields, the disagreement between experiment and prediction increases significantly for both Al- and TaSi/Al-gate capacitors, and can be greater than a factor of 2 at applied electric fields below 0.1 MV/cm. For medium energy (~100 keV average photon energy) x-ray irradiations, the enhanced device response exhibits a much stronger dependence on endpoint bremsstrahlung energy than expected from TIGERP or CEPXS/ONETRAN simulations. Implications for hardness assurance testing are discussed.

27657 Simulation fidelity issues in reactor irradiation of electronics – Reactor environments. Kelly, J.G. (Sandia National Labs., Albuquerque, NM (US)); Luera, T.F.; Posey, L.D.; Williams, J.G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1242-1247 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

Fast burst reactors (FBRs), such as SPR III, and pool-type reactors, such as the University of Illinois TRIGA and the Sandia Annular Core Research Reactor, are used as sources of neutrons and/or gamma rays in transient radiation effects in electronics (TREE) research and testing. Here the authors identify the important simulation fidelity issues, compare radiation environments produced in representative reactors, and describe custom environments that have been achieved to better meet experimenter requirements.

27658 Total-dose hardness assurance issues for SOI MOSFETs. Fleetwood, D.M. (Sandia National Labs., Albuquerque, NM (US)); Tsao, S.S.; Winokur, P.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1361-1367 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

The top-gate, back-gate, and sidewall response of SIMOX and ZMR SOI/MOS transistors to 10 keV x-ray and Co-60 irradiation is compared. For top-gate and sidewall insulators, Co-60 and 10-keV x-ray irradiations at matched dose rates lead to nearly identical response. Back-gate response, on the other hand, depends strongly

on radiation energy and buried insulator thickness. Differences are observed of up to 60 percent for SIMOX (0.4 μm buried oxide), and up to 300 percent for ZMR (2.0 μm buried oxide), with Co-60 leading to increased response. Different x-ray to Co-60 correlation factors may be observed for other technologies with different sidewall and buried insulator materials and thicknesses. The authors demonstrate that it is not possible to define a generic set of worst-case radiation bias conditions for all SOI technologies. For these devices, it is shown that back-gate radiation response can be a strong function of transistor drain bias during exposure.

27659 Charge collection in silicon for ions of different energy but same linear energy transfer (LET). Stapor, W.J. (Naval Research Lab., Washington, DC (US)); McDonald, P.T.; Knudson, A.R.; Campbell, A.B.; Glagola, B.G. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1585-1590 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

Charge collection measurements in thin silicon structures have indicated that the charge collected is not the same for incident ions with the same LET but with different energies. More charge is collected for the higher energy ions than for the lower energy ions. The observed differences are larger than can be explained by uncertainties in energy loss calculations. A possible explanation is in differences in initial track structure. The higher energy track is more diffuse and may yield more charge to be collected because there is less initial electron-hole pair recombination.

27660 Fabrication and total dose testing of a 256Kx1 radiation hardened SRAM. Kushner, R.A. (AT and T Bell Labs., Allentown, PA (US)); Kohler, R.A.; Steenwyk, S.D.; Desko, J.C.; Alchesky. L.C.; Arnold, R.H.; Benevit, C.A.; Clemons, D.G.; Longfellow, D.A.; Flores, R.S. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 35(6): 1667-1669 (Dec 1988). (CONF-880730–: 25. annual conference on nuclear and space radiation effects, Portland, OR, US, July 12, 1988).

This paper describes a 256Kx1 radiation hard SRAM, the process enhancements which resulted in its successful fabrication, and presents total dose exposure results. Typical measured performance values include an address-activated access time of 36 nsec and a write time of 34 nsec. Soft-error studies predict the memory cell to be SEU insensitive and rail-span collapse simulations estimate transient dose immunity to greater than 4E9 rads(Si)/sec. The basic technology used was a standard 1.0μm two-level metal, non-SORT CMOS, radiation hard process. SORT refers to Selective Oxidation to Reduce Topography, a process which uses silicon nitride masking of active device areas during field oxide growth to reduce vertical dimensions.

27661 Energy deposition by partially stripped ions in gases and condensed media. Crawford, O.H. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6123). *Physical Review [Section] A: General Physics (USA),* 39(9): 4432-4439 (1 May 1989).

Energy deposition in matter by atoms and partially stripped ions is studied. Expressions for the collisional and restricted collisional energy deposition rates are derived for high-velocity nonrelativistic projectiles, using Bethe theory. These formulas are intended for the calculation of amounts of energy deposited into a target at depths less than the mean path for change in electronic state of the projectile. Calculations are presented for hydrogen atoms, protons, and electrons on aluminum and graphite targets.

6550 Medical Physics

27662 (BLG–607) **Measurement of the natural radiation of the Belgian territory.** Gillard, J.; Flemal, J.M.; Deworm, J.P.; Siegers, W. Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). [1989]. 18p. Order Number DE89610517/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A measurement campaign of natural occuring radionuclides was set up on the Belgian territory in order to assess the doses received by the Belgian population. The results of the measurements are published together with a map of natural occuring radionuclides and exposure rates. (L.D.C.).

27663 (INIS-BR–1458, pp. 89) **Beta and gamma individual monitoring with thermoluminescent dosemeters.** Campos, L.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Rosa, L.A.R. da. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BETA DETECTION/gamma detection; BETA DETECTION/personnel monitoring; BETA DETECTION/thermoluminescent dosemeters; GAMMA DETECTION/beta detection; GAMMA DETECTION/personnel monitoring; GAMMA DETECTION/thermoluminescent dosemeters; THERMOLUMINESCENT DOSEMETERS/personnel monitoring; DOSE EQUIVALENTS

27664 (INIS-BR–1458, pp. 167) **Determination of the counting efficiency of phoswich detectors for the assessment of internal contamination in lungs and lymph nodes by using mathematical model.** Righetti, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Hernandez, D.; Spano, F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

AMERICIUM 241/lungs; AMERICIUM 241/lymph nodes; AMERICIUM 241/radionuclide kinetics; RADIONUCLIDE KINETICS/mathematical models; RADIONUCLIDE KINETICS/phantoms; LUNGS; BODY BURDEN; KEV RANGE 10-100; PHOTON TRANSPORT; PHANTOMS

27665 (INIS-BR–1458, pp. 266) **Procedures to accelerate the decorporation of cesium-137 in patients with internal contamination - Goiania radioactive accident.** Farina, R. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CESIUM 137/brazil; CESIUM 137/radiation accidents; PERSONNEL MONITORING/decontamination; PERSONNEL MONITORING/radiation accidents; PERSONNEL MONITORING/remedial action; BRAZIL; DIURETICS; EXCRETION; FERROCYANIDES; DECONTAMINATION; POTASSIUM COMPOUNDS; WHOLE-BODY COUNTING

27666 (INIS-BR–1469) **Radiation protection program of Petrobras.** Signorini, M. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1988. 13p. (In Portuguese). (CONF-8806348–: 6. seminar on industrial safety, Curitiba, BR, June 21, 1988). Order Number DE89610508/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Risks present in oil industry require specific control programs, specialy when using radioactive sources. Main uses of ionizing radiation in oil industry are in process control systems, industrial radiography and oilwell logging. A comprehensive and sistemic program is presented in order to assure the safe use of ionizing radiation in these activities. Principal subjects of this program are the control of radioactive sources, personel training in order to difuse knowledge at operations level and procedures standardization.

27667 (INIS-BR–1470) **Implantation of the norm for gammagraphy-REDUC experience (5 years).** Brasil, F.; Pinheiro, R. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1988. 6p. (In Portuguese). (CONF-8806348–: 6. seminar on industrial safety, Curitiba, BR, June 21, 1988). Order Number DE89610509/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The situation of Duque de Caxias Refinery related to the safety of gammagraphy tests, is presented. (M.C.K.).

27668 (INIS-mf–11406, pp. 50) **New tool for monitoring of the effect of external and internal radiation by chemiluminescence activity of pulmonary macrophages.** Szegedi, I. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Namenyi, J.; Gachalyi, A.; Varga, L.P. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHEMILUMINESCENCE/biological indicators; LUNGS/radiation monitoring; RADIATION MONITORING/lungs; CHEMILUMINESCENCE; INHALATION; INTERNAL IRRADIATION; LUNGS; MACROPHAGES; RADIONUCLIDE ADMINISTRATION; RESPIRATORY SYSTEM DISEASES; WHOLE-BODY IRRADIATION

27669 (INIS-mf–11406, pp. 88) **Radiation and the environment.** Sztanyik, B.L. (Orszagos Frederic Joliot-Curie Sugarbiologiai es Sugaregeszseguegyi Kutato Intezet, Budapest (Hungary)); Nikl, I. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HUNGARY/radiation monitoring; NATURAL RADIOACTIVITY/environmental impacts; DOSE RATES; HUNGARY; RADIATION DOSES; RADIATION SOURCES

27670 (INIS-mf–11406, pp. 93) **Dose assessment and medical consequences of radiation-exposure of employees of Electricite de France. The present statement and a discussion of the feasibility of epidemiological studies.** Bertin, M. (Electricite de France, 75 - Paris (France). Comite de Radioprotection); Lallemand, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

FRANCE/medical surveillance; PERSONNEL DOSIMETRY/nuclear power plants; PERSONNEL MONITORING/france; EPIDEMIOLOGY; FRANCE; RADIATION DOSES

27671 (INIS-mf–11406, pp. 98) **Biochemical indicators in human blood for radiation dose assessment.** Stamm, A. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene); Schreiber, G.; Hofmann, R.; Boegl, K.W. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOLOGICAL DOSEMETERS/blood; BIOLOGICAL INDICATORS/blood; BIOCHEMISTRY; BLOOD; DOSE-RESPONSE RELATIONSHIPS; IN VITRO

27672 (INIS-mf–11406, pp. 45) **Energy deposition and ionization yields of photon radiations in sites of DNA dimensions.** Olko, P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin); Schmitz, Th.; Booz, J. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, IL, October 24, 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DNA/energy absorption; PHOTOIONIZATION/microdosimetry; DNA; EXTERNAL IRRADIATION; PHOTOIONIZATION; MICRODOSIMETRY; SPATIAL DOSE DISTRIBUTIONS; WATER VAPOR

27673 (INIS-SU–81/A, pp. 23-29) **Radiation dose in radiodiagnosis of neonates.** Varchenya, V.Zh. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

A problem of investigating absorbed doses in neonate organism in roentgenological examinations is put to be solved. For the first time absorbed doses in 16 organs in various projections in 11 types of roentgenological examinations in anthropomorphic heterogenous neonate phantom are obtained using thermoluminescent dosimetry. The results analysis showed that the organs in the field of irradiation and nearly organs get maximal doses. It is recommended to align and diaphragm the beam thoroughly in order to prevent whole-body irradiation of neonate. 11 refs.; 4 tabs.

27674 (INIS-SU–81/A, pp. 29-39) **Tissue doses in radiodiagnosis of children.** Kal'nitskij, S.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

The data on doses forming in most radiosensitive children organs and tissues in main roentgenological examinations are given. The doses are calculated on th base of known dose values in tissues and in the air obtained by Rosenstein who used Monte Carlo method in children mathematical phantoms. The data permit to perform control over children irradiation level in radiodiagnosis. The measures to limit children irradiation doses are given. 12 refs.; 4 tabs.

27675 (INIS-SU–81/A, pp. 64-71) **On the role of homeostasis in formation of dose loads in patients in case of radionuclide diagnosis.** Belyachkov, Yu.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

The effect of patients homostasis systems on radiation doses formation in organs and tissues was studied. Radionuclide diagnosis, computer simulation and calculation dosimetric methods were applied. A comparison of stochastic simulation results was performed. The effect of homeostasis system on labelled compounds dynamics was shown. A conclusion on further failure of classical chamber anlysis concepts in analyzing complex biological system dynamics was drawn. The proposed methodological principles can be used in studying interaction processses in complex systems in medicine, chemistry, biology. 14 refs.

27676 (INIS-SU–81/A, pp. 72-78) **Radiation safety problems in radiation treatment of non-tumoural diseases.** Maksimova, T.A.; Yamson, V.A. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

An analysis of dosimetric observations was performed to determine doses of irradiation of most radiosensitive organs and tissues of patients. The efficiency of protective devices is evaluated. The ways and methods to decrease dose of irradiating healthy tissues with preserving therapeutic effect are shown. Application of skin radioprotective substances and certain regulation of radiation doses are the real ways to decrease unfavourable effect of ionizing radiation. 17 refs.; 2 tabs.

27677 (INIS-SU–81/A, pp. 78-83) **Increase of radiation protection of medical personnel participating in gynecologic roentgenological examinations.** Bolotova, A.F.; Gubatova, D.Ya.; Trunova, N.I.; Trunov, B.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Radiation hygienic working conditions of gynecologists performing hysterosalpingography are studied. Systematic individual dosimetric control showed that annual doses of gynecologists performing roentgenological examinations are 2.7-6.5 Sv. These doses are approximating and even exceeding the dose limits, adopted by NRP-76 for B category. A protective screen, providing optimization

of working conditions of radiological gynecologists and permitting to increase functional radiation loads of the specialists are developed. 3 refs.; 2 figs.; 2 tabs.

27678 (IPEN-PUB–223) **Nuclear occupational safety in uranium conversion facility at the IPEN-CNEN/SP.** Gaburo, J.; Silva, T. de M. da; Sordi, G.-M.A.A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Oct 1988. 20p. (In Portuguese). Order Number DE89610533/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

After a brief description of the operations involved in the Uranium Process Conversion at the IPEN-CNEN/SP it is shown the principal radioactive sources exposure, the health physics procedures implemented and finally are discussed the doses received by the workers. The health physics measurements includ air sampling, internal contamination control by bioassay analysis and workplace monitoring for external radiation. The air monitoring results show in some points that the radiation levels are very near of the 3/10 of the DAC, but the permanence of the workers are very short. This fact is confirmed by the results of the bioassay analysis performed on the workers.

27679 (KIYI–88-1) **Dosimetric plan of distance irradiation.** AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 35p. (In Russian). Order Number DE89780085/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Individual papers are indexed separately

27680 (KIYI–88-1, pp. 14-23) **Dose rate distribution at mobile remote fast neutrons irradiation in medico-biological complex of Kiev U-120 cyclotron.** Svarichevskaya, E.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Dosimetric plan of distance irradiation.* Order Number DE89780085/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Dose distributions of fast neutrons in case of irradiation rotation modes in experiments with tissue-equivalent phantoms are invesigated. Anthropomorphous phantom of human body was used to simulate irradiation processes when considering concrete clinical problems. The use of rotational modes permits to concentrate the dose for the focus and to reduce radiation burden on skin, but it also increases the volume of tissues in irradiated area. 7 refs.; 4 figs.

27681 (KIYI–88-2) **Medico-biological complex of Kiev cyclotron U-120 (MBC U-120).** AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 35p. (In Russian). Order Number DE89780086/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Individual papers are indexed separately

27682 (KIYI–88-2, pp. 26-31) **Radiation situation parameters at remote neutron therapy of cancer patients in medico-biological complex of Kiev U-120 cyclotron.** Koval', G.N.; Svarichevskaya, E.V.; Tatsij, Yu.A.; Churyumova, T.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Medico-biological complex of Kiev cyclotron U-120 (MBC U-120).* Order Number DE89780086/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Works on the evaluation of radiation situation in the U-120 microbiological complex are carried out. It is shown that γ-radiation exposure dose rate (EDR) and the density of fast and thermal neutron flux in rooms adjacent to procedure hall are lower the admissible levels and annual dose burden on personnel does not exceed 16.2 mrem, as regards the time of residence in the measurement room. The adjustment of a lead gate in front of the collimator permitted to reduce γ-radiation EDR in the procedure hall, when preparing patients for irradiation, by a factor of $\sim$ 2.5. Thus the dose burden on personnel (registered nurse) will not exceed 1.84 rem a year. 5 tabs.

27683 (PNL–6800-Pt.4) **Pacific Northwest Laboratory annual report for 1988 to the DOE Office of Energy Research: Part 4, Physical sciences.** Touburen, L.H. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 75p. DOE Contract AC06-76RL01830. Order Number DE89010762/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document contains brief descriptions of various research programs in the physical science. Topics include Chernobyl Information Management, Supercritical Fluids, Laser Spectroscopy, DNA Adducts, Dosimetry, Biophysics, and Genetic Damage. (TEM)

6560 Condensed Matter Physics

Refer also to citation(s) 26437, 26561, 26738, 26788, 26789, 26790, 26793, 26805, 27642, 27645, 27650, 27659

27684 (INIS-BR–1458, pp. 133) **Kinetics of the Ag^0 center in aluminium borate glasses.** Santos, J.T. dos (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Pontuschka, W.M.; Isotani, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM COMPOUNDS/borates; ALUMINIUM COMPOUNDS/glass; BORATES/aluminium compounds; BORATES/glass; GLASS/gamma radiation; GLASS/irradiation; GLASS/kinetics; BORATES; GLASS; ANNEALING; ELECTRON SPIN RESONANCE; IRRADIATION; KINETICS; IMPURITIES; RUNGE-KUTTA METHOD; SILVER; TEMPERATURE DEPENDENCE

27685 (INIS-BR–1458, pp. 142) **Stability of defects and thermoluminescence in some doped KCl crystals.** Mdebuka, A.M. (Fort Hare Univ. (South Africa). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POTASSIUM CHLORIDES/doped materials; POTASSIUM CHLORIDES/interstitials; POTASSIUM CHLORIDES/thermoluminescence; ACTIVATION ENERGY; EMISSION SPECTRA; GAMMA RADIATION; IRRADIATION; LITHIUM; MEDIUM TEMPERATURE; INTERSTITIALS; THERMOLUMINESCENCE; SODIUM; STABILITY

27686 (INIS-BR–1458, pp. 141) **Exoelectron emission from ion implanted MgO single crystal.** Chubaci, J.F.D. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Watanabe, S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

MAGNESIUM OXIDES/exoelectrons; MAGNESIUM OXIDES/monocrystals; MONOCRYSTALS/dosimetry; MONOCRYSTALS/exoelectrons; ANNEALING; HELIUM IONS; HYDROGEN IONS 1 PLUS; ION IMPLANTATION; IRRADIATION; EXOELECTRONS; MONOCRYSTALS; DOSIMETRY; VACUUM SYSTEMS; X RADIATION

27687 (INIS-BR–1458, pp. 108) **Line asymmetry in the X-ray photoemission spectra of Ar and K implanted in AL.** Abbate, M. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM/argon; ALUMINIUM/potassium; ARGON/aluminium; ARGON/x-ray emission analysis; POTASSIUM/aluminium; POTASSIUM/x-ray emission analysis; ALUMINIUM; ARGON; POTASSIUM; ASYMMETRY; ELECTRON GAS; FERMI LEVEL; IMPURITIES; K SHELL

27688 (INIS-BR–1458, pp. 107) **Kα and Kβ X-ray emission spectra of metallic potassium.** Leiro, J.A. (Turku Univ. (Finland). Inst. of Physics); Heinonen, M.H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order

Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

POTASSIUM/k shell; POTASSIUM/x-ray emission analysis; HARTREE-FOCK METHOD; L-S COUPLING; POTASSIUM

27689 (INIS-BR–1458, pp. 104) **K X-ray emission from solid neon.** Lefebvre, A. (Facultes Universitaires Notre-Dame de La Paix, Namur (Belgium)); Deconninck, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NEON/k shell; NEON/solids; NEON/x-ray emission analysis; ION IMPLANTATION; IRRADIATION; METALS; NEON; SOLIDS; RUTHERFORD SCATTERING; SAMPLE PREPARATION

27690 (INIS-BR–1458, pp. 102) **Xanes of the outer shell in HCL and HBr.** Yavna, V.A. (Rostov Railway Engineers Inst., Rostov-on-Don (USSR). Chair of Physics); Popov, V.A.; Demekhin, V.F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HYDROBROMIC ACID/bound state; HYDROBROMIC ACID/molecular structure; HYDROCHLORIC ACID/bound state; HYDROCHLORIC ACID/molecular structure; ABSORPTION; CROSS SECTIONS; PHOTONS

27691 (INIS-BR–1458, pp. 229) **Importance of change in valence by irradiation of the doped impurities in the alkali halides during the coloration curves.** Ramos B, S. (Universidad Nacional Autonoma de Mexico, Mexico City); Soto M, R.; Rosete A, C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HALIDES/irradiation; HALIDES/radiation effects; HALIDES/valence; COLORATION; DOPED MATERIALS; F CENTERS; GAMMA RADIATION; H CENTERS; HALIDES; IRRADIATION; VALENCE; IMPURITIES

27692 (INIS-BR–1458, pp. 210) **Annealing of heavy ion radiation damage in solids and single activation energy mode.** Virk, H.S. (Guru Nanak Dev Univ., Amritsar (India)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

SOLIDS/activation energy; SOLIDS/annealing; SOLIDS/physical radiation effects; HEAVY IONS; MATHEMATICAL MODELS; SOLIDS; ANNEALING

27693 (INIS-BR–1458, pp. 207) **Effects of target thickness fluctuations in energy loss measurements of proton beams traversing thin films: determination of surface roughness.** Capuj, N.E. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche); Sckardt, J.C.; Lantschner, B.H.; Arista, N.R.; Jakas, M.M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PROTON BEAMS/energy losses; PROTON BEAMS/targets; TARGETS/roughness; TARGETS/thickness; ALUMINIUM; COPPER; FOILS; GOLD; KEV RANGE 10-100; KEV RANGE 100-1000; TARGETS; SILVER; ROUGHNESS; THICKNESS

27694 (INIS-BR–1458, pp. 215) **Characterization of semiconductor processing by ^{119}Sn conversion electron Moessbauer spectroscopy.** Baumvol, I.J.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

SEMICONDUCTOR MATERIALS/moessbauer effect; SEMICONDUCTOR MATERIALS/silicon; SEMICONDUCTOR MATERIALS/tin 119; SILICON/semiconductor materials; ANNEALING; IMPURITIES; SILICON; SPUTTERING; THIN FILMS

27695 (INIS-BR–1458, pp. 214) **Observation of hydrogen trapping sites in austenitic stainless steel SUS316L by tritium transmission electron microscopy autoradiography.** Saito, H. (Tokyo Univ. (Japan)); Miyazawa, K.; Ishida, Y. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

STEEL-CR17NI12MO3-L/autoradiography; STEEL-CR17NI12MO3-L/hydrogen; STEEL-CR17NI12MO3-L/trapping; TRITIUM/autoradiography; TRITIUM/transmission electron microscopy; GRAIN BOUNDARIES; STEEL-CR17NI12MO3-L; AUTORADIOGRAPHY; HYDROGEN; TRAPPING; TRITIUM

27696 (INIS-BR–1458, pp. 213) **Transmission electron microscopic tritium autoradiography of an overaged austenite stainless steel SUS316.** Saito, H. (Tokyo Univ. (Japan)); Miyazawa, K.; Nogawa, N.; Mori, M.; Morikawa, N.; Ishida, Y. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

AUTORADIOGRAPHY/steel-cr17ni12mo3-l; STEEL-CR17NI12MO3-L/autoradiography; STEEL-CR17NI12MO3-L/transmission electron microscopy; STEEL-CR17NI12MO3-L/tritium; AUTORADIOGRAPHY; STEEL-CR17NI12MO3-L; CHROMIUM CARBIDES; GRAIN BOUNDARIES; PRECIPITATION; TRITIUM

27697 (INIS-BR–1458, pp. 205) **^{57}Fe CEMS characterization of Fe-Al thin film alloys.** Vasconcellos, M.A.Z. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Inst. de Fisica); Teixeira, S.R.; Dionisio, P.H.; Schreiner, W.H.; Baumvol, I.J.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM/alloys; ALUMINIUM/thin films; IRON/alloys; IRON/thin films; IRON 57/alloys; IRON 57/moessbauer effect; IRON 57/thin films; ALUMINIUM; ALLOYS; ANNEALING; IRON; SILICON OXIDES; SUBSTRATES

27698 (INIS-BR–1458 IV.27) **Reduction of electron contamination generated by 10 MV X-rays.** Parthasaradhi, K. (Andhra Univ., Visakhapatnam (India)); Mallikarjuna Rao, B.; Guru Prasad, S.; Lee, Y.; Ruperal, R.; Graces, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON CHANNELING/radiations; DEPTH DOSE DISTRIBUTIONS; RADIATIONS; FILTERS; LEAD

27699 (INIS-SU–37/A, pp. 54-60) **Development and application of nuclear reaction methods for surface diagnostics.** Kuz'min, L.E. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Methods for solid surface layer diagnosis based on nuclear reaction promp radiation monitoring - resonance (NRR) and spectra (NRS), are considered. Correctness of methods for desired function reduction is illustrated using the determination of profiles of ^{15}N concentrations in GaAs and the excitaion function of the $^{12}C(d,p)^{13}C$ reaction. Examples of NRR and NRS method applications in microelectronics and radiation technique are given. 14 refs.; 9 figs.

27700 (INIS-SU–37/A, pp. 51-53) **Study of the thermal diffusion of ion-alloyed cesium in aluminium, silicon and titanium by the Rutherford backscattering method.** Bulgakov, Yu.V. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Savel'eva, L.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *General and nuclear physics. Scientific-technical collection.* Order Number DE88780177/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 1(37).

Thermal diffusion of cesium implanted at 120 keV energy in monocrystal silicon and in polycrystal aluminium and titanium is investigated by the method of Rutherford backscattering (RBS). Parameters of temperature dependence of the cesium diffusion coefficient in materials given above are determined. Cesium is shown to be one of the most movable impurities. 7 refs.; 2 figs.; 2 tabs.

27701 (INIS-SU–77/A, pp. 280-284) **Scattering of ultracold neutrons by subatomic structure of a substance in a condensed state.** Antonov, A.V. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Isakov, A.I.; Kuznetsov, S.P. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The method of the determination of the submicroscopic inhomogeneity size distributions in a substance is elaborated. The method of the inhomogeneity shape and size determination resulted from the very cold neutron propagation experiments is proposed. 5 refs.; 2 figs.

27702 (INIS-SU–77/A, pp. 294-298) **Interaction of very cold neutrons with H_2O, D_2O and aqueous solution of dodecyl oxithylene glycol.** Isakov, A.I. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Kuznetsov, S.P.; Langer, O.A. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The wavelength dependences of the total cross sections ($\Sigma(\lambda)$) for the very cold neutrons (VCN) (λ>3nm) interactions with H_2O and D_2O are given. With the help of VCN the superstructure of the liotropic liquid crystal (LIC) the water solution of the dodecyloxyethylen glycol - was investigated. 6 refs.; 2 figs.

27703 (INIS-SU–79, pp. 71-72) **Nature of the dielectric charge exchange effect.** Uvarov, V.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, UA, June 2, 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

It is shown that experimentally observed injected charge distribution in dielectrics is due to spatial distribution of thermalized electrons and ionization losses. 8 refs.; 2 figs.

27704 (PNL-SA–16256) **Deposition of dielectric optical coatings: A microstructural study of the deposited layers and interfaces.** McCarthy, J.M.; Thomas, L.E.; Pawlewicz, W.T.; Frydrych, W.S.; Exarhos, G.J. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 8p. DOE Contract AC06-76RL01830. (CONF-890426–6: Spring meeting of the Materials Research Society, San Diego, CA, US, April 24, 1989). Order Number DE89011205/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thin dielectric films are deposited on substrates for optical applications using a variety of techniques including reactive sputtering, sol-gel reaction, and ion assisted plasma deposition. This transmission electron microscopy study characterizes the microstructures of optical coatings produced by the above deposition techniques and shows how changing deposition conditions changes microstructure and subsequently the optical properties. 5 refs., 7 figs.

6561 Superconductivity

Refer also to citation(s) 26761, 26762, 26766, 26769

27705 (CONF-890113–1) **Single crystal NMR studies of high temperature superconductors.** Pennington, C.H.; Durand, D.J.; Zax, D.B.; Slichter, C.P.; Rice, J.P.; Bukowski, E.D.; Ginsberg, D.M. Illinois Univ., Urbana, IL (USA). 1989. 25p. DOE Contract AC02-76ER01198. From High resolution nuclear magnetic resonance in solids; Cambridge, MA, US; January 19, 1989. Order Number DE89011220/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The authors report Cu NMR studies in the normal state of a single crystal of the T_c = 90 K superconductor $YBa_2Cu_3O_{7-\delta}$. The authors have measured the magnetic shift tensor, the electric field gradient tensor, the nuclear spin-lattice relaxation rate tensor, and the time dependence and functional form of the transverse decay. From these data they obtain information about the charge state and magnetic state of the Cu atoms, and the existence and size of the electronic exchange coupling between spins of adjacent Cu atoms. 18 refs., 3 figs., 2 tabs.

27706 (INIS-BR–1458, pp. 53) **Recent developments in detector research.** Proebst, F. (Muenchen Univ. (Germany, F.R.)); Kraus, H.; Peterreins, Th.; Feilitzsch, F.V. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIATION DETECTORS/phonons; RADIATION DETECTORS/superconducting junctions; SUPERCONDUCTING JUNCTIONS/radiation detectors; SUPERCONDUCTING JUNCTIONS/x radiation; ABSORPTION; ALPHA PARTICLES; ENERGY RESOLUTION; EV RANGE 100-1000; KEV RANGE 01-10; PHONONS; TIN OXIDES

27707 (UCRL–100604) **Electronic structure of high temperature superconductors.** Sterne, P.A. Lawrence Livermore National Lab., CA (USA). Feb 1989. 9p. DOE Contract W-7405-ENG-48. (CONF-8904123–1: 4. international conference on superconducting, Santa Clara, CA, US, April 30, 1989). Order Number DE89008610/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Electronic structure calculations on high temperature superconductors using the Linear Muffin Tin Orbital (LMTO) method are presented. The LMTO method, a first principles electronic structure method based on density functional theory, is briefly reviewed. Results are then presented for three different applications. First, applications of the method to structural and magnetic properties of La_2CuO_4 are presented. Next, calculations on bismuth-containing copper-oxide superconductors are discussed. These motivate a discussion of the importance of interlayer coupling for superconductivity. Finally, oxygen ordering in the $YBa_2Cu_3O_{7-y}$ system is considered by using first principles calculations to determine the effective pair interactions for use in statistical mechanical models of system. 29 refs., 5 figs.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 26886

27708 (INIS-BR–1458, pp. 25) **Harmonic generation in laser-free electron scattering reconsidered.** Puntajer, A.K. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik); Leubner, C. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRONS/laser radiation; ELECTRONS/scattering; HARMONIC GENERATION/photons; HARMONIC GENERATION/scattering; ASYMMETRY; COHERENT RADIATION; CROSS SECTIONS; ELECTRODYNAMICS; ELECTRONS; SCATTERING; PHOTONS

70 FUSION ENERGY

Refer also to citation(s) 27617

27709 (ENEA-RT-FUS–88-9) **Contributions to the 12 th International Conference on plasma physics and controlled nuclear fusion research. Nice, 12-19 October 1988.** ENEA, Rome (Italy). 1988. 19p. Order Number DE89609767/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Two papers prepared by Italian team working in the framework of the Associazione EURATOM-ENEA sulla Fusione are presented. They deal respectively with plasma microinstabilities and plasma heating in Frascati Tokamak.

7001 Plasma Research

Refer also to citation(s) 27576

27710 (CONF-890384–3) **Pellet ablation and ablation model development.** Houlberg, W.A. Oak Ridge National Lab., TN (USA). 1989. 9p. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on H mode physics; Gut Ising, DE; March 20, 1989. Order Number DE89011235/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A broad survey of pellet ablation is given, based primarily on information presented at this meeting. The implications of various experimental observations for ablation theory are derived from qualitative arguments of the physics involved. The major elements of a more complete ablation theory are then outlined in terms of these observations. This is followed by a few suggestions on improving the connections between theory and experimental results through examination of ablation data. Although this is a rather aggressive undertaking for such a brief (and undoubtedly incomplete) assessment, some of the discussion may help us advance the understanding of pellet ablation. 17 refs.

27711 (CONF-890545–1) **The data acquisition and control system for Thomson Scattering on ATF [Advanced Toroidal Facility].** Stewart, K.A.; Kindsfather, R.R.; Rasmussen, D.A. Oak Ridge National Lab., TN (USA). 1989. 5p. DOE Contract AC05-84OR21400. From 6. conference on real-time computer applications in nuclear, particle and plasma physics; Williamsburg, VA, US; May 15, 1989. Order Number DE89007820/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The 2-dimensional Thomson Scattering System measuring electron temperatures and densities in the Advanced Toroidal Facility (ATF) is interfaced to a VAX-8700 computer system running in a clustered configuration. Calibration, alignment, and operation of this diagnostic is under computer control. Extensive CAMAC instrumentation is used for timing control, data acquisition, and laser alignment. This paper will discuss the computer hardware and software, system operations, and data storage and retrieval. 3 refs.

27712 (DOE/ET/53088–366) **Anomalous electron thermal conduction from magnetic turbulence.** Hong, B.G.; Horton, W. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Mar 1989. 10p. DOE Contract FG05-80ET53088. (IFSR–366). Order Number DE89010617/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The electron thermal balance equation from Braginskii equations with the finite Larmor radius heat flux is analyzed for the space-time averaged power balance in the presence of electromagnetic fluctuations. Formulas for the anomalous thermal flux associated with the $E \times B$ motion and the magnetic $\delta B_\perp$ fluctuation are derived and evaluated for the c/ω_{pe} scale electromagnetic turbulence typical of the ∇T_e driven short wavelength drift modes. The result is compared with several Ohkawa-type formulas for the anomalous electron thermal energy transport. 9 refs.

27713 (ENEA-RT-FUS–88-9, pp. 5-11) **Microinstability based models of anomalous energy transport in Tokamak.** Barbato, E. (ENEA, Frascati (Italy). Centro Ricerche Energia); Briguglio, S.; Cardinali, A.; Cenacchi, G.; Ottaviani, M.; Romanelli, F.; Vlad, G.; Zonca, F. ENEA, Rome (Italy). 1988. (CONF-881015–: 12. international conference on plasma physics and controlled nuclear fusion research, Nice, FR, October 12, 1988). In *Contributions to the 12 th International Conference on plasma physics and controlled nuclear fusion research. Nice, 12-19 October 1988.* Order Number DE89609767/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A microinstability based model of anomalous energy transport is presented which relies on the effect of the electrostatic modes destabilized by ion temperature gradients and trapped electron dynamics. The threshold for the onset of the instability is determined by the linear analysis of the kinetic dispersion relation. Numerical simulations are presented which show good agreement with the experimental results. A possible model for the electron transport at the edge is discussed. A short description of the lower hybrid power deposition code is also given.

27714 (GA-A–19608) **Mode conversion at the higher ion cyclotron harmonics.** Chiu, S.C.; Chan, V.S.; Harvey, R.W.; Porkolab, M. General Atomics, San Diego, CA (USA). Mar 1989. 8p. DOE Contract AC03-89ER53277. (CONF-8905120–1: 8. topical conference on radio frequency power in plasmas, Irvine, CA, US, May 1, 1989). Order Number DE89010033/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It has been demonstrated that mode conversion of fast waves to ion Bernstein waves can be calculated from a reduced second order differential equation for the wave fields rather than the 4th order equations used in earlier studies near the ion-ion hybrid resonance and the second harmonic resonance. Here the underlying justification of the method is discussed. It is shown that the method works for high harmonic resonances and an analytical formula for the tunneling coefficient is derived. The result is a generalization of a previous result obtained by Ngan and Swanson and is applicable when $\kappa_\perp \rho_i$ is large. Recently, there is interest in using fast waves for current drive at high ion cyclotron harmonics frequencies in tokamaks. Generally, the fast wave will encounter ion cyclotron within the plasma cross-section. For efficient current drive, the minimization of the mode conversion processes sets restrictions to the choice of frequencies and magnetic fields. This is discussed using the derived formula. 14 refs., 1 fig.

27715 (INIS-BR–1458, pp. 246) **Finite radiation temperature effects on high-frequency strongly coupled classical plasma waves in a magnetic field.** Genga, R.O. (Nairobi Univ. (Kenya). Dept. of Physics). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PLASMA WAVES/coupling; PLASMA WAVES/magnetic fields; PLASMA WAVES/temperature dependence; SHORT WAVE RADIATION/coupling; SHORT WAVE RADIATION/magnetic fields; SHORT WAVE RADIATION/temperature dependence; OSCILLATION MODES; COUPLING; PLASMONS; WAVE PROPAGATION

27716 (INIS-BR–1458, pp. 253) **Measurements of the X-ray radiation in the 'Flora' device.** Czekaj, S. (Institute of Plasma Physics and Laser Microfusion, Warsaw (Poland)); Sledzinski, S.; Gribkow, V.A.; Dubrowskij, A.V.; Krochin, O.N. Sao Paulo Univ., SP

(Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LASER RADIATION/plasma focus devices; LASER RADIATION/radiation effects; PLASMA FOCUS DEVICES/hard x radiation; MEASURING METHODS; NEODYMIUM LASERS

27717 (INIS-BR–1458, pp. 250) **Optimization of implosion phase on T.C-I by light emission analysis.** Aramaki, E.A. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Porto, P.; Ueda, M.; Machida, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FIELD-REVERSED THETA PINCH DEVICES/implosions; FIELD-REVERSED THETA PINCH DEVICES/optimization; PLASMA DIAGNOSTICS/field-reversed theta pinch devices; PLASMA DIAGNOSTICS/helium; PLASMA DIAGNOSTICS/implosions; ELECTRON DENSITY; FARADAY CUPS; IMPLOSIONS; OPTIMIZATION; ION TEMPERATURE; MAGNETIC PROBES; OPERATION; PHOTODIODES; HELIUM; SPECTROMETERS

27718 (INIS-BR–1458, pp. 256) **Generation of intense neutron pulses by using a laser-plasma ion source.** Bykovsky, Y.A. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)); Tsybin, A.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

LASER-PRODUCED PLASMA/hydrogen ions; LASER-PRODUCED PLASMA/ion beam targets; NEUTRON SOURCES; VACUUM SYSTEMS

27719 (INIS-BR–1458, pp. 252) **Effect of the magnetic field on the plasma parameters.** Ghoranneviss, M. (Atomic Energy Organization, Teheran (Iran). Plasma Group); Elahi, M.; Pirayandeh, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

PLASMA PRODUCTION/magnetic fields; ALUMINIUM; CYLINDERS; DISTRIBUTION FUNCTIONS; ION SOURCES; PLASMA DENSITY

27720 (INIS-BR–1458, pp. 251) **Heating of a plasma by two radiation fields regarding nuclear fusion experiments.** Fonseca, A.L.A. (Brasilia Univ. (Brazil). Dept. de Fisica); Nunes, A.C.; Aragao, F.R.F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BEAM INJECTION HEATING/laser-radiation heating; BEAM INJECTION HEATING/thermonuclear reactions; LASER-RADIATION HEATING/beam injection heating; LASER-RADIATION HEATING/thermonuclear reactions

27721 (INIS-BR–1458, pp. 245) **X-ray radiation in laser-produced high-Z plasma.** Jun, Z. (Institute of Applied Physics and Computational Mathematics, Beijing (China)); Tie-qiang, C.; Shao-ze, X.; Cheng-zhi, S.; Guang-nan, C.; Xi-wen, Y. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

X RADIATION/laser-produced plasma; ABSORPTION; CONVERSION; GOLD; SCALING LAWS; SIMULATION; TARGETS

27722 (INIS-BR–1458, pp. 247) **Spectroscopic study of radiation produced in a theta-pinch.** Trigueiros, A.G. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Pagan, C.J.B.; Machida, M. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ENERGY LEVELS/ionization; ENERGY LEVELS/theta pinch; ARGON; ELECTRON TEMPERATURE; IONIZATION; GASES; ION TEMPERATURE; KRYPTON; NEON; NITROGEN; OXYGEN; SPECTRA; XENON

27723 (LA-UR–89-868) **The FRX-C/LSM compression experiment.** Rej, D.J.; Siemon, R.E.; Taggart, D.P. Los Alamos National Lab., NM (USA). 1989. 6p. DOE Contract W-7405-ENG-36. (CONF-8903100–3: 9. U.S. compact toroid symposium, Union, WA, US, March 14, 1989). Order Number DE89009358/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

After two years of preparation, hardware for high-power FRC compression heating studies is now being installed onto FRX-C/LSM. FRCs will be formed and translated out of the θ-pinch source, and into a compressor where the external B-field will be increased from 0.4 to 2 T in 55 μs. The compressed FRC can then be translated into a third stage for further study. A principal experimental goal is to study FRC confinement at the high energy density, $n(T_e + T_i) \leq 1.0 \times 10^{22}$ keV/m^3, associated with the large external field. Experiments are scheduled to begin in April. 11 refs., 5 figs.

7002 Fusion Power Plant Technology

Refer also to citation(s) 26745, 27710

27724 (BLG–593) **Exotic development of ceramic tritium breeding materials. Annual progress report 1985.** Kennedy, P.; Conrad, R.; Kwast, H.; Brauns, E. Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Nov 1986. 33p. Order Number DE89609823/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the near future fusion reactors will be based on the tritium-deuterium plasma reaction. As such the production of tritium, a non-natural element, becomes of crucial importance in fusion technology. An experimental programme, EXOTIC, is in progress since 1983 in which the laboratories of SNL-Springfields, ECN-Petten, JRC-Petten and SCK-CEN Mol work in close collaboration within the framework of the manufacture, characterization and irradiation of ceramic lithium compounds. This programme must result in the understanding of the tritium release processes and the effect of material characteristics on this release. Up to now three irradiation experiments in the High Flux Reactor-Petten were scheduled (EXOTIC I, II and III). The Annual Progress Report 1985 summarizes information on these experiments during the period of 1985. The reader is also referred to the previous Annual Progress Report 1984. During the EXOTIC I experiment lithium silicate pellets and lithium aluminate pellets were irradiated. The resulting tritium release data are still to be interpreted in full detail. Some preliminary observations are presented in this Report. In the EXOTIC II experiment lithium oxide, lithium aluminate and lithium silicate pellets were used. In the EXOTIC III experiment lithium oxide, lithium zirconate and lithium silicate pellets were used.

27725 (DOE/ET/51013–T210) **Failure modes and effects analysis of fusion magnet systems.** Zimmermann, M.; Kazimi, M.S.; Siu, N.O.; Thome, R.J. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. Dec 1988. 150p. DOE Contract AC02-78ET51013. (PFC/RR–88-17). Order Number DE89010945/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

A failure modes and consequence analysis of fusion magnet system is an important contributor towards enhancing the design by improving the reliability and reducing the risk associated with the operation of magnet systems. In the first part of this study, a failure mode analysis of a superconducting magnet system is performed. Building on the functional breakdown and the fault tree analysis of the Toroidal Field (TF) coils of the Next European Torus (NET), several subsystem levels are added and an overview of potential sources of failures in a magnet system is provided. The failure

analysis is extended to the Poloidal Field (PF) magnet system. Furthermore, an extensive analysis of interactions within the fusion device caused by the operation of the PF magnets is presented in the form of an Interaction Matrix. A number of these interactions may have significant consequences for the TF magnet system particularly interactions triggered by electrical failures in the PF magnet system. In the second part of this study, two basic categories of electrical failures in the PF magnet system are examined: short circuits between the terminals of external PF coils, and faults with a constant voltage applied at external PF coil terminals. An electromagnetic model of the Compact Ignition Tokamak (CIT) is used to examine the mechanical load conditions for the PF and the TF coils resulting from these fault scenarios. It is found that shorts do not pose large threats to the PF coils. Also, the type of plasma disruption has little impact on the net forces on the PF and the TF coils. 39 refs., 30 figs., 12 tabs.

27726 (EGG-M–13887) **Safety considerations in the CIT design.** Holland, D.F.; Lyon, R.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1987. 4p. DOE Contract AC07-76ID01570. (CONF-871007–138: 12. symposium on fusion engineering, Monterey, CA, US, October 12, 1987). Order Number DE89011146/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents analysis of the Compact Ignition Tokamak (CIT) to determine the adequacy of the safety design features to meet the proposed safety design objectives. Since the goal of the Compact Ignition Tokamak (CIT) is to achieve an ignited plasma, tritium will be used in fueling and sufficient neutrons will be produced to activate nearby gases. As a result of safety considerations related to accidental release of tritium or activated gases, several safety features have been incorporated into the design. In developing safety features, design objectives limiting public exposure were proposed based on the estimated probability of occurrence. To meet these objectives, safety features have been proposed that emphasize an inherent/passive approach. By employing risk analysis techniques such as event trees that describe accident scenarios, the adequacy of these features has been evaluated and, when appropriate, the design was modified to meet design objectives. This process will continue through the design phase. 4 refs., 3 figs., 2 tabs.

27727 (EGG-M–88266) **Safety analysis of the Compact Ignition Tokamak radiation shield.** Lyon, R.E.; Cadwallader, L.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 6p. DOE Contract AC07-76ID01570. (CONF-881031–69: 8. topical meeting on technology of fusion energy, Salt Lake City, UT, US, October 9, 1988). Order Number DE89011145/JAW. Available from NTIS, PC A02 - OSTI.

The baseline design of the Compact Ignition Tokamak (CIT) includes a center cell which acts as a radiation shield around the CIT machine. The safety aspects of this shield have been examined. Production of activated gas during machine operation has been investigated and the resulting doses for release under normal operation and accident conditions have been calculated. Helium, nitrogen, carbon dioxide and air have been considered for use as the CIT cover gas. Helium has several safety advantages; however, due to its relatively high cost, other gases are being considered. Nitrogen and carbon dioxide are candidates since they have a lower cost and produce short-lived activation products. Other safety aspects of the shield are also considered. The shield is found to be beneficial to CIT. 9 refs., 2 figs., 3 tabs.

27728 (ENEA-RT-FUS–88-14) **Contributions to the 15th Symposium on Fusion Technology. Utrecht 19-23 Sep 1988.** ENEA, Rome (Italy). 1988. 49p. Order Number DE89609796/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report contains seven papers presented to the 15th. Symposium on fusion tecnology by ENEA scientists. They deal mainly with the FTU machine and the Italian contribution to NET.

27729 (ENEA-RT-TIB–88-29) **Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.** ENEA, Rome (Italy). 1988. 103p. Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The report contains ten papers contributing to the first International conference on new laser technologies held in Olympia from 19 to 23 June 1988. They represent the activities in this field carried out by the ENEA Department of Basic Technologies.

27730 (ENEA-RT-TIB–88-29, pp. 69-74) **Preliminary tests of a pseudo spectral Fourier propagation code to be used for high gain laser cavity studies.** Agnesi, A. (Pavia Univ. (Italy). Dipt. di Elettronica); Gabetta, G.; Flora, F.; Hermensent, T.; Reali, G.T. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Numerical methods for simulation of loaded laser cavities are largely devoted to the dynamic evolution of the transverse field distribution. Results on transverse field profile evolution have been published using various numerical methods like finite-difference schemes, Gaussian mode expansion and spectral methods based on trigonometric polynomial mode expansion. The latter methods is particular advantageous because of the existence of very efficient algorithms such as Fast Fourier Transform (FFT). A similar approach is used to solve the field in unstable laser cavities with high gain active medium such as XeCl. The preliminary test presented here constitute the first attempt to optimize our numerical code for nonlinear behaviors such as self-focussing and bistability.

27731 (ENEA-RT-TIB–88-29, pp. 75-94) **FEL gain in the Compton regime.** Caloi, R. (Rome Univ. (Italy). Dipt. di Fisica); Dattoli, G.; Giannessi, L.; Hermesen, T.; Ricchetta, M.; Torre, A. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

In this paper the problem of gain calculation in a FEL operating in the Compton regime is dealt with. The limit of validity of the so-called linear theory is analyzed and is reviewed the modification induced by high gain effects. The complications associated with the short pulse operation are also considered as well as the gain reduction due to inhomogeneous broadening contributions.

27732 (ENEA-RT-TIB–88-29, pp. 61-67) **Simulation of optical cavity configurations for XeCL lasers.** Agnesi, A. (Pavia Univ. (Italy). Dipt. di Elettronica); Reali, G.C.; Boffa, V.; Flora, F.; Hermsen, T.; Torre, A. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The results of numerical simulation of various optical cavity configuretions with XeCl active medium are presented. Discussed are the Self Filtering Unstable Resonator (SFUR), the positive branch unstable resonator and the combined oscillator-amplifier. Comparison with available experimental data is made where possible.

27733 (ENEA-RT-TIB–88-29, pp. 51-59) **SFUR laser expansion in gaussian beams.** Barbini, R. (ENEA, Frascati (Italy). Centro Ricerche Energia); Colao, F.; Petri, A. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The output laser field of a SFUR (Self Filtering Unstable Resonator) is expanded in Laguerre-Gaussian solution of the Helmoltz wave equation paraxial approximation. The relative contributions of different modes are evaluated and main parameters of the laser beam, such as waist are computed. It is proposed a way to propagate the output laser beam in free space by means of LG solutions.

27734 (ENEA-RT-TIB–88-29, pp. 43-49) **Interferometrical diagnostic of a XeCl discharge.** De Angelis, A. (ENEA, Frascati

(Italy). Centro Ricerche Energia); Di Lazzaro, P.; Garossi, F.; Giordano, G.; Letardi, T. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The time - and space - resolved behaviour of the electron density ganerated in the activi medium of a self-sustained discharge XeCl laser has been measured by means of a Mach-Zehnder holographic interferometry set-up.

27735 (ENEA-RT-TIB–88-29, pp. 31-41) **Excimer laser photolysis of Z_n dialkyls for Z_n deposition.** Larciprete, R. (ENEA, Frascati (Italy). Centro Ricerche Energia); Borsella, E. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Excimer laser induced photochemistry of dimetlylzinc (DMZn) and diethylzinc (DEZn) has been investigated by multiphoton ionization time-of-flight mass spectroscopy. After the results achieved, DEZn was chosen as precursor compound for zinc film photodeposition. The organometallic was photolyzed by a focussed KrF excimer laser beam perpendicularly impinging onto a quartz substrate. Localized zinc deposition with thicknesses in the range 300/3000. A have been obtained and the deposition process has been investigated by monitoring the time evolution of the fraction of a He-Ne laser beam transmitted by the growing zinc film.

27736 (ENEA-RT-TIB–88-29, pp. 23-29) **Pused CO_2 laser driven production of ultrafine Silicon, Silicon carbide, Silicon nitrides oxynitride powders.** Borsella, E. (ENEA, Frascati (Italy). Centro Ricerche Energia); Cneve, L.; Fantoni, R.; Piccirillo, S. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Ultrafine Si, Si_3N_4, SiC and silicon oxynitride powders have been produced by irradiating gas-phase reactants by means of a CO_2 laser. The mechanism of SiH_4 CO_2 laser induced absorption and dissociation is discussed on the basis of the results of the spectral and time resolved measurement of fragment chemiluminescence. The role played by the SiH_2 radical in the powder formation is investigated. The quality of Si, Si_3N_4, SiC and silicon oxynitride powders is checked by means of several off-line diagnostics (IR spectroscopy, X-Ray diffraction at wide and small angle, BET analysis). The possibility of controlling powder stoichiometry and doping from the gas-phase reactant concetration is discussed.

27737 (ENEA-RT-TIB–88-29, pp. 15-22) **Resonant CO_2 laser induced breakdown in polyatomic molecules.** Fantoni, R. (ENEA, Frascati (Italy). Centro Ricerche Energia); Borsella, E.; Caneve, L.; Piccirillo, S. ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, U, US, June 19, 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The onset of CO_2 laser induced breakdown has been observed by irradiating several polyatomic species (SiH_4, NH_3, hydrocarbons, fluorohydrocarbons) at a wavelength resonant with an IR active vibration. Primary fragmentation and subsequent ion and radical secondary reactions have been monitored detecting the spontaneous luminescenue with a gateable Optical Multichannel Analyzer. The resonant laser induced processes can be of importance in etching reactors were hydrocarbons and fluoro-hydrocarbons are commonly used, as well as in laser chemical vapour deposition reactors for the productions of sinterable Si_3N_4 and SiC powders.

27738 (INIS-BR–1458, pp. 56) **EURAC: a concept for a European Accelerator Neutron Source.** Kley, W.; Bishop, G.R.; Sinha, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FIRST WALL/neutron sources; NEUTRON SOURCES/first wall

27739 (INIS-BR–1458, pp. 248) **Heat flux calculation for the laser fusion problem.** El Wakil, S.A. (Mansoura Univ. (Egypt). Dept. of Physics); Attia, M.T.; El Labany, S.; Saad, E.A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

FUEL PELLETS/deuterium; FUEL PELLETS/heat flux; FUEL PELLETS/tritium; LASER IMPLOSIONS/fuel pellets; LASER IMPLOSIONS/heat flux; BOUNDARY CONDITIONS; ELECTRON DENSITY; ELECTRON-ION COLLISIONS; DEUTERIUM; TRITIUM; SURFACES; TRANSPORT THEORY

27740 (INIS-SU–77/A, pp. 33-40) **Thermonuclear reactors and requirements for neutron data.** Markovskij, D.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Orlov, V.V.; Shatalov, G.E.; Sherstnev, K.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

Plasma energy balance in various thermonuclear reactors is considered. Activation neutron reactions for the main components of structural materials are given, the measurement of their cross sections being necessary for the development of thermonuclear reactors. Problems related to the construction of experimental thermonuclear power reactor are discussed. 4 refs.; 1 fig.

27741 **Low density microcellular carbon foams and method of preparation.** Arnold, C. Jr.; Aubert, J.H.; Clough, R.L.; Rand, P.B.; Sylwester, A.P. To Dept. of Energy. USA Patent Application 7-209,168. 20 Jun 1988. 17p. DOE Contract AC04-76DP00789. Order Number DE89010966/JAW. Available from NTIS, PC A03 - OSTI.

A low density, open-celled microcellular carbon foam is disclosed which is prepared by dissolving a carbonizable polymer or copolymer in a solvent, pouring the solution into a mold, cooling the solution, removing the solvent, and then carbonizing the polymer or copolymer in a high temperature oven to produce the foam. If desired, an additive can be introduced in order to produce a doped carbon foam, and the foams can be made isotropic by selection of a suitable solvent. The low density, microcellular foams produced by this process are particularly useful in the fabrication of inertial confinement fusion targets, but can also be used as catalysts, absorbents, and electrodes.

27742 **Beta heating driven deuterium–tritium ice redistribution, modeling studies.** Martin, A.J. (KMS Fusion, Inc., Ann Arbor, Michigan 48106); Simms, R.J.; Wineberg, S.B. *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films (USA),* 7(3): 1157-1160 (May 1989).

We have previously demonstrated, based upon a one-dimensional analysis, that beta heating could cause a redistribution of nonuniform deuterium–tritium (DT) ice within a cryogenic target at an ideal rate that would decrease nonuniformity by a factor of 10 every hour. Our analysis was extended to address two pertinent questions: for a spherical target, where will the DT ice finally go and how quickly will it get there? This analysis is a two-dimensional heat and mass transfer problem. We have used PLTMG, a state-of-the-art multigrid computer code for the analysis. For the "tent" mount method of positioning a target in a cryogenic enclosure, an ice layer nonuniformity of <1% can be achieved. We have evaluated the rate of ice redistribution and report its variation as a function of ^3He content within the target, the target temperature, target geometry, and thermal conductivity of the shell wall.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 27769

27743 (BLG–590) **Mol - Research Division Report 1986 - 1.** Delbarre, J.; Assche, P. van (eds.). Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Nov 1986. 189p. Order Number DE89611031/JAW. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

This report covers the research activities carried out at the SCK-CEN, Mol from the middle of 1985 till mid 1986. It deals with materials science, metallurgy, ceramics, nuclear chemistry, chemical engineering, biology, nuclear meteorology and analytical chemistry. (MCB).

27744 (UCRL–99484) **Low fineness ratio kinetic energy penetrators.** Cline, C.F.; Gogolewski, R.P.; Reaugh, J.E. Lawrence Livermore National Lab., CA (USA). Feb 1989. 26p. DOE Contract W-7405-ENG-48. (CONF-890585–4: 11. international symposium on ballistics, Brussels, BE, May 9, 1989). Order Number DE89008828/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have modeled the penetration process of a low fineness ratio, heavy metal kinetic energy projectile impacting a semi-infinite steel target at and above typical ordnance speeds using the Lawrence Livermore National Laboratory (LLNL) two-dimensional, finite difference code, GLO. We have also performed ballistic experiments using an LLNL two-stage light gas gun to gather data over a range of impact speeds from 2.0 to 7.5 km/s. On this basis, we have constructed relationships between penetration efficiency (total penetration/projectile length), projectile fineness ratio (projectile length/profile diameter), and projectile impact speed. Furthermore, we have constructed a three-dimensional surface of penetration efficiency for tungsten alloy projectiles impacting semi-infinite steel. From these constructions, it is straightforward to determine minimum kinetic energy requirements at a target for a prespecified level of penetration. 12 refs., 16 figs., 3 tabs.

9901 Management

Refer also to citation(s) 26442, 26618, 26635, 27785, 27790

27745 (DOE/MA–0375) **Department of Energy audit resolution, followup and internal control review activity: Quarterly management report as of December 31, 1988.** USDOE Assistant Secretary for Management and Administration, Washington, DC (USA). Audit Liaison Div. Apr 1989. 69p. Order Number DE89011184/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report provides information to Department of Energy (DOE) managers on the status of audit followup, General Accounting Office (GAO), Inspector General (IG) and internal control system activity for the quarter ended December 31, 1988. It is based on information accumulated and maintained by the Audit Liaison Division, Office of the Controller, pursuant to DOE 2300.1A (AUDIT RESOLUTION AND FOLLOWUP), 2340.1B (COORDINATION OF GENERAL ACCOUNTING OFFICE ACTIVITIES), 2320.2A (ESTABLISHMENT OF DEPARTMENTAL POSITION ON INSPECTOR GENERAL REPORTS) and 1000.3B (INTERNAL CONTROL SYSTEMS). Readers who wish to submit comments or discuss the contents of this report, may contact the Audit Liaison Division (202-586-1910 or FTS 896-1910).

27746 (DP-MS–88-170) **Computerized management of time, tasks, and priorities.** Miller, P.E. (ed.). Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1988. 50p. DOE Contract AC09-76SR00001. (CONF-890523–1: 36. international technical communication conference, Chicago, IL, US, May 14, 1989). Order Number DE88017001/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Even before Egyptian times, fiber and paper-based methods were used to manage time, tasks, and priorities. Papyrus and paper were effective in their time, but now is the time for the even more effective computer-based methods of time management. This study compares paper and computer methods of the management of time, tasks, and priorities. Discussed are recommended strengths of off-the-shelf software for time management. Integrated software is recommended. A case study of the use of idea processing software to manage publication tasks and priorities is examined. Illustrated–for classroom-style training–are uses of a computer to enhance the quality and increase the efficiency of the coordination of publications from conception and research to printing and issuance. 3 refs., 43 figs.

27747 (FNAL/C–89/36) **Peer review, basic research, and engineering: Defining a role for QA professionals in basic research environments.** Bodnarczuk, M. Fermi National Accelerator Lab., Batavia, IL (USA). Feb 1989. 11p. DOE Contract AC02-76CH03000. (CONF-8809334–1: 16. annual conference of the American Society for Quality Control and Energy, Ft. Lauderdale, FL, US, September 12, 1988). Order Number DE89011083/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Within the context of doing basic research, this paper seeks to answer four major questions: (1) What is the authority structure of science? (2) What is peer review? (3) Where is the interface between basic physics research and standard engineering? and (4) Given the conclusions to the first three questions, what is the role of the QA professional in a basic research environment like Fermilab? 23 refs.

27748 (INIS-BR–1458, pp. 51) **Utilization of intense neutron generators in science and technology.** Csikai, G.J. (Kossuth Lajos Tudomanyegyetem, Debrecen (Hungary)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, BR, October 3, 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Order Number DE89609976/JAW. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NEUTRON SOURCE FACILITIES/research programs; NEUTRON SOURCE FACILITIES/uses; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; USES; NUCLEAR DATA COLLECTIONS

27749 (K/QT–210) **A scientific approach to quality in R and D.** Kidd, G.J. Jr. Oak Ridge Gaseous Diffusion Plant, TN (USA). 1989. 18p. DOE Contract AC05-84OT21400. (CONF-890530–1: 3. international congress of the International Council on Applied Mineralogy, Montreal, CA, May 14, 1989). Order Number DE89001602/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As quality concepts are beginning to be applied to areas other than traditional manufacturing environments, we see a whole spectrum of results. So far it has been hard to predict when a quality program will succeed or fail or to understand why. This paper explains why the difficulty exists; it also presents an approach that enhances the probability that a program will be acceptable to the scientific community, an approach that is based on systems analysis and uses nomenclature and techniques already familiar to technically trained people. This approach extends some of the existing quality principles to allow more focus on processes than on products. Recognizing that much of the output of scientific effort is subjective, it proposed some alternatives for measuring and evaluating those types of results. 13 refs., 4 figs.

27750 (UCRL–99538) **Modularized training for technical editors.** Murphy, P.W. Lawrence Livermore National Lab., CA (USA). 8 Sep 1988. 9p. DOE Contract W-7405-ENG-48. (CONF-890535–1: 36. international technical communication conference, Chicago, IL, US, May 14, 1989). Order Number DE89001293/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper outlines the editorial services provided at the Lawrence Livermore National Laboratory (LLNL), sketches a syllabus of basic training for technical editors, describes the approach being used to develop this cost-effective individualized instruction for editors (experienced or not) new to work at LLNL, and enumerates the advantages of this approach. 8 refs.

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Refer also to citation(s) 26248, 26313, 26332, 26347, 26453, 26484, 26500, 26503, 26509, 26528, 26534, 26540, 26548, 26549, 26570, 26572, 26573, 26575, 26592, 26629, 26630, 26645, 26670,

26671, 26720, 26755, 26804, 26866, 26871, 26871, 26872, 26873, 26874, 26899, 26901, 26911, 26912, 26928, 26942, 26958, 26967, 27010, 27012, 27026, 27027, 27030, 27031, 27041, 27059, 27138, 27146, 27521, 27561, 27711, 27744, 27746

27751 (AD-A–202657/3/XAB) **Vectorized hidden-surface algorithm implemented on the Cray-2 supercomputer. Master's thesis.** Donehower, R. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Dec 1988. 102p. (AFIT/GCS/ENG–88D-3). Available from NTIS, PC A06/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Recent developments in scientific computing have prompted the need for supercomputer graphics research. These developments include the requirement to visualize large amounts of data processed by the supercomputer, preferably by real-time image generation. Unfortunately, most currently used graphics algorithms are not optimized for vector computers. This thesis involves the design and implementation of a hidden-surface removal algorithm for the Cray-2 vector supercomputer, with the goal of real-time image display. A z-buffer hidden-surface algorithm, written in Pascal, was vectorized and implemented on the Cray-2. Special attention was directed toward the methodology of algorithm and data-structure design to exploit the Cray-2 architecture. Timing studies comparing the vector version to the equivalent scalar version showed that, while tha Pascal vector code produced localized speedups, the vector code was less efficient than the scalar code.

27752 (AD-A–203087/2/XAB) **Virtual Time Machine. Technical report.** Fujimoto, R.M. Utah Univ., Salt Lake City, UT (USA). Dept. of Computer Science. 10 Jan 1989. 34p. (UUCS–88-019). Available from NTIS, PC A03/MF A01.

Existing multiprocessors and multicomputers require the programmer or compiler to perform data-dependence analysis at compile time. The author proposes a parallel computer that performs this task at runtime. In particular, the Virtual Time Machine (VTM) detects violations of data-dependence constraints as they occur, and automatically recovers from them. A sophisticated memory system that is addressed using both a spatial and a temporal coordinate is used to efficiently implement this mechanism. Initially targeted for discrete-event simulation applications, many of the ideas used in the machine architecture have direct application in the more-general realm of parallel computation. The long-term goal of this work is to develop a general purpose parallel computer that will support a wide range of parallel programming paradigms. This paper outlines the motivations behind the VTM architecture, the underlying computation model, a proposed implementation, and initial performance results. A recurring theme that pervades the entire paper the our contention that existing shared memory and message-base machines do not pay adequate attention to the dimension of time. It is argued that this architectural deficiency is the underlying reason behind many difficult problems in parallel computation today.

27753 (AD-A–203088/0/XAB) **Time Warp on a shared-memory multiprocessor. Technical report.** Fujimoto, R.M. Utah Univ., Salt Lake City, UT (USA). Dept. of Computer Science. 10 Jan 1989. 35p. (UUCS–88-021A). Available from NTIS, PC A03/MF A01.

A variation of the Time Warp parallel discrete-event simulation mechanism is presented that is optimized for execution on a shared-memory multiprocessor. In particular, the direct cancellation mechanism is proposed that eliminates the need for anti-messages and provides an efficient mechanism for cancelling erroneous computations. The mechanism thereby eliminates many of the overheads associated with conventional, message-based implementations of Time Warp. More importantly, this mechanism effects rapid repairs of the parallel computation when an error is discovered. Initial performance measurements of an implementation of the mechanism executing on a BBN Butterfly multiprocessor are presented. These measurements indicate that the mechanism achieves good performance, particularly for many workloads where conservative clock synchronization algorithms perform poorly. Speedups as high as 56.8 using 64 processors were obtained. However, the studies also indicate that state saving overheads represent a significant stumbling block for many parallel simulations using Time Warp.

27754 (AD-A–203092/2/XAB) **Design specifications for hardware-assisted rollback computation.** Thomson, R. University of Southern California, Los Angeles, CA (USA). Jun 1988. 15p. (USC–88-014). Available from NTIS, PC A03/MF A01.

An overview of rollback computation is given, followed by a series of possible design strategies to implement rollback computations in hardware. Design issues and trade-offs are examined for each of the strategies as an iteration to the chosen strategy. The implementation of the chosen strategy is discussed along with an outline of remaining work.

27755 (AD-A–203150/8/XAB) **FX-87 performance measurements: data-flow implementation. Technical report.** Hammel, R.T.; Gifford, D.K. Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science. Nov 1988. 54p. (MIT/LCS/TR–421). Available from NTIS, PC A04/MF A01.

This report documents a series of experiments performed to explore the thesis that the FX-87 effect system permits a compiler to schedule imperative programs (i.e., programs that may contain side-effects) for execution on a parallel computer. The authors analyze how much the FX-87 static effect system can improve the execution times of five benchmark programs on a parallel graph interpreter. Three of their benchmark programs do not use side-effects (factorial, fibonacci, and polynomial division) and thus did not have any effect-induced constraints. Their FX-87 performance was comparable to their performance in a purely functional language. Two of the benchmark programs use side effects (DNA sequence matching and Scheme interpretation) and the compiler was able to use effect information to reduce their execution times by factors of 1.7 to 5.4 when compared with sequential execution times. These results support the thesis that a static effect system is a powerful tool for compilation to multiprocessor computers. However, the graph interpreter we used was based on unrealistic assumptions, and thus our results may not accurately reflect the performance of a practical FX-87 implementation. The results also suggest that conventional loop analysis would complement the FX-87 effect system

27756 (AD-A–203392/6/XAB) **Nonprocedural implementation of mathematical-programming algorithms. Technical report for FY88.** Ho, J.K. Tennessee Univ., Knoxville, TN (USA). Management Science Program. Dec 1988. 13p. (MSP–88-1). Available from NTIS, PC A03/MF A01.

It is shown that the implementation of many mathematical-programming algorithms using spreadsheet software can be described as instances of a nonprocedural approach to computer programming. This concept is generalized to an abstract computing environment called HYPERCELLS. Its significance in view of rapid development in parallel computation is discussed. With the widespread use of microcomputers in academia, business, industry and government, spreadsheet software has become the most-popular general-purpose quantitative tool for numerical computation. It is essentially a two-dimensional array of cells. Each cell may contain text for documentation, numerical values from data, or a formula dependent on values in other cells. Whenever the value in a cell is changed, the content of cells with formulas depending on it can be recalculated automatically.

27757 (AD-A–203447/8/XAB) **VAX to CRAY NASTRAN user interface. Final report, July 1986-July 1987.** James, M.R. Applied Technology Associates, Inc., Albuquerque, NM (USA). Oct 1988. 71p. Available from NTIS, PC A04/MF A01.

The Air Force Weapons Laboratory has access to both the NASTRAN and PATRAN software systems for structural analysis investigations; however, these two codes are resident on separate computer systems at AFWL. NASTRAN is used to perform the bulk of large structural analysis research and is resident on the CRAY1S. PATRAN is installed on Silicon Graphics and allows depictions and animation of modal analysis results. The two software packages are complementary in function, and communication between them can be achieved through the GATEWAY facility. The GATEWAY links the AFWLO4 VAX, the silicon Graphics IRIS, and the CRAY through a common network protocol. This document describes software residential on the VAX and CRAY computer systems which allows PATRAN animation of NASTRAN calculated modal shapes. This section contains general information which should be reviewed by all potential users. Section 2 outlines the

step by step implementation of NASTRAN calculation and PATRAN animation. This approach is designated VAX/CRAY/VAX processing. The VAX/CRAY/VAX approach is appropriate regardless of whether the NASTRAN model was created on the Silicon Graphics using PATRAN or created on the VAX using an editor. Section 3 provides important notes on the use of the existing NASTRAN DMAP alter library, and Section 4 is an example computer session implementing VAX/CRAY/VAX processing as described in Section 2.

27758 (CONF-880117–10) **Reliability mechanisms for ADAMS (Advanced DAta Management System).** Son, Sang H.; Pfaltz, J.L. Virginia Univ., Charlottesville, VA (USA). Inst. for Parallel Computation. 20 Mar 1988. 21p. DOE Contract FG05-88ER25063. (IPC-TR–88-002). From 3. conference on hypercube concurrent computers and applications; Pasadena, CA, US; January 19, 1988. Order Number DE89010911/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goal of checkpointing in database management systems is to save database states on a separate secure device so that the database can be recovered when errors and failures occur. This paper presents a non-interfering checkpointing mechanism being developed for ADAMS. Instead of waiting for a consistent state to occur, our checkpointing approach constructs a state that would result by completing the transactions that are in progress when the global checkpoint begins. The checkpointing algorithm is executed concurrently with transaction activity while constructing a transaction-consistent checkpoint on disk, without requiring the database quiesce. This property of non-interference is highly desirable to real-time applications, where restricting transaction activity during the checkpointing operation is in many cases not feasible. Two main properties of this checkpointing algorithm are global consistency and reduced interference, both of which are crucial for achieving high availability. 21 refs., 1 fig.

27759 (CONF-8905100–1) **Using a segregation measure for the workload characterization of multi-class queuing networks.** Dowdy, L.W.; Krantz, A.T.; Leuze, M.R. Oak Ridge National Lab., TN (USA). 1989. 16p. DOE Contract AC05-84OR21400. From International conference on measurement and modeling of computer systems; Berkeley, CA, US; May 23, 1989. Order Number DE89007841/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When a queuing network model of a computer system is constructed, the workload is characterized by several parameters known as the device demands. The demand that every customer places upon every device must be specified. A complete workload characterization of a K device network with N different customers contains N * K parameters. Substantial savings in complexity result if the number of workload parameters is decreased. If, for example, only the average demands on the K devices are used in the workload characterization, the overhead of parameter collection is reduced, and the solution of the queuing network model is simplified. With this approach, however, the multi-class system is represented by a single-class model. A loss of accuracy results. It has been recently demonstrated that the performance of a multi-class network is bounded below by its single-class counterpart model and is bounded above by a simple function based upon the single-class model. In this paper, a new workload characterization technique is proposed which requires: the K average device demands for the single-class counterpart model and a segregation measure, a value which indicates the degree to which different customers tend to utilize different parts of the network. The segregation measure specifies the point between the two bounds where the multi-class model's performance lies. This measure is quite intuitive and is simple to calculate. The technique provides an accurate estimate of the performance of a multi-class network. 6 refs., 5 figs., 3 tabs.

27760 (CONF-8905109–1) **Review of the 1988 workshop on human-machine symbiotic systems.** Parker, L.E.; Weisbin, C.R. Oak Ridge National Lab., TN (USA). 1989. 5p. DOE Contract AC05-84OR21400. (CESAR–89/14). From Workshop on integration of AI and robotic systems; Scottsdale, AZ, US; May 19, 1989. Order Number DE89008743/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report presents a review of the 1988 Workshop on Human-Machine Symbiotic Systems. Held December 5–6, 1988 in Oak Ridge, Tennessee, the workshop served as a forum for the discussion of several critical issues in human-machine symbiosis: human-machine communication, autonomous task planning and execution monitoring for heterogeneous agents, dynamic task allocation, human-machine system architecture, and machine learning via experience and human observation. The presentation of overview papers by invited keynote speakers provided a background for the breakout session discussions in these five areas. A summary of the conclusions and recommendations for future work resulting from the workshop is reported. 6 refs.

27761 (CONF-8905119–1) **Probabilistic risk analysis in conjunction with FAST-E parametric cost estimating.** Williams, K.A.; Freiman, F.R. Oak Ridge National Lab., TN (USA). 1989. 15p. DOE Contract AC05-84OR21400. From 11. annual conference of the International Society of Parametric Analysts (ISPA); McLean, VA, US; May 8, 1989. Order Number DE89009616/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Probabilistic methods for multivariable uncertainty analysis, such as the Monte Carlo method, have been used for many years to evaluate cost risks and health/safety risks associated with complex processes or systems simulated by specialized computer models. The US Department of Energy, Office of Defense Programs, is sponsoring an effort to link a Monte Carlo driver code (ORMONTE), developed at Oak Ridge for economic risk analysis, with the generalized parametric cost evaluation model FAST-E (Freiman Advanced Systems Technique-Equipment). FAST-E is widely used in the military/aerospace/weapons industry to predict the cost of proposed new systems. The FAST-E cost-scaling algorithms utilize the attributes of mew systems concepts. The attributes cover areas such as: performance/energy considerations, state of the art or technology, and mass (weight). Other factors include the equipment's functional environment, economics and its applicable engineering, and production activities. 4 refs., 5 figs.

27762 (DOE/ER/13118–T3) **Caltech Concurrent Computation Program annual report, 1984–1985: Final technical report.** Fox, G.C. California Inst. of Tech., Pasadena, CA (USA). Jul 1985. 14p. DOE Contract AS03-83ER13118. Order Number DE89009717/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the current status of the Caltech Concurrent Computation Program, which is a major effort at both the Caltech campus and JPL (Jet Propulsion Laboratory). The major goal of the program is to develop the capability of concurrent processors for general purpose computation with special emphasis on science and engineering. An important feature of our approach is that the members of the project are scientists who lead in the use of computational techniques in their respective research fields, and have already developed state-of-the-art programs on sequential machines. Computers whose (hypercube) architectures "scale" to a large number of nodes are being developed and, consequently, to much greater computational power than any sequential machines. It has been possible to take advantage of advances in computer science and applied mathematics in all three areas of hardware, software and algorithms. The project currently includes researchers in applied mathematics, astrophysics, chemistry, computer science, condensed matter, geophysics, high energy physics, image processing, and structural mechanics.

27763 (DOE/ER/25063–T6) **Compact 0-complete trees: A new method for searching large files.** Orlandic, R.; Pfaltz, J.L. Virginia Univ., Charlottesville, VA (USA). School of Engineering and Applied Science. 26 Jan 1988. 50p. DOE Contract FG05-88ER25063. (IPC-TR–88-001). Order Number DE89010921/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, a novel approach to ordered retrieval in very large files is developed. The method employs a B-tree like search algorithm that is independent of key type or key length because all keys in index blocks are encoded by a 1 byte surrogate. The replacement of actual key sequences by the 1 byte surrogate ensures a maximal possible fan out and greatly reduces the storage overhead of maintaining access indices. Initially, retrieval in binary trie structure is developed. With the aid of a fairly complex recurrence relation, the rather scraggly binary trie is transformed into compact multi-way search tree. Then the recurrence relation itself is replaced by an unusually simple search algorithm. Then implementation details and

empirical performance results are presented. Reduction of index size by 50%–75% opens up the possibility of replicating system-wide indices for parallel access in distributed databases. 23 figs.

27764 (DOE/OR/00033–T418) **Optimization of life prediction using uncertain data.** Boerigter, S.T. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Nuclear Engineering. Dec 1988. 234p. DOE Contract AC05-76OR00033. Available from Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139.

A general methodology for the optimization of an experimental design program with respect to uncertainty is developed. Among the unique features of this methodology is the use of error-in-variables estimation algorithms which treat the observed data as uncertain data. By using experimental data and a physically based, parametric model, the life of materials at service conditions can be predicted. All experimental data are assumed to contain normal, random error which can be defined by a variance. This error may be measurement error, for example. Nonlinear, multi-variate parameter estimation algorithms, which make use of the error in the independent variables, were employed to enhance model estimation and the calculation of error. Computational tools were developed which simulate data sets, allowing the evaluation of the limitations of parameter estimation routines. The methodology developed in this thesis was implemented in a computer algorithm called OPEXD. OPEXD generates simulated experiments which it sequentially evaluates. The code uses estimates of the error to generate not only the optimized set of experiments but also predictions in obtainable uncertainties. The methodology was specifically applied to the prediction of life of a mild steel nuclear waste container undergoing uniform corrosion in a bedded salt repository environment. An optimized sequence of experiments as well as quantitative measures of reduction in uncertainty are obtained. 23 refs., 28 figs., 3 tabs.

27765 (DP-MS–88-236) **IMPACT: An expert system for environmental impact assessment.** Loehle, C.; Osteen, R. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). 1989. 19p. DOE Contract AC09-76SR00001. (CONF-8904111–8: Southeastcon '89 conference and exhibition, Columbia, SC, US, April 9, 1989). Order Number DE89010748/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Environmental assessment has become a routine part of the planning process for major development projects and land management activities, particularly within the federal government. Federal projects such as dams, highways, and timber cutting fall under NEPA (National Environmental Policy Act) and other regulations. We have developed an expert system screening tool that collects information on the proposed activity and checks for possible environmental problems. It is designed to have a high degree of certainty for no impact conclusions but to only point out the need for outside expert consultation when possible problems are found. Its purpose is to assist civil engineers, urban planners, environmental engineers, project managers, and environmental regulators in the early stages of project planning. Many of these people do not have extensive ecological training or may be new on the job. Consequently, of the many possible environmental problems that could result from an activity, some are almost always overlooked. An expert system screening tool provides a standard, public procedure for all projects; contains a complete list of environmental issues; only requires data relevant to the proposed activity; and acts as a training tool and source of expertise for novices. 25 refs., 1 tab.

27766 (EGG-M–19687) **Online process observation.** Kaplan, B. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1987. 5p. DOE Contract AC07-76ID01570. (CONF-8710101–2: 31. annual Human Factors Society meeting, New York, NY, US, October 19, 1987). Order Number DE89011150/JAW. Available from NTIS, PC A02 - OSTI.

Process observation techniques for face-to-face interactions were applied in the online environment found useful for identifying some fundamental issues in the design and implementation of computer conferences for training. Key questions were found to include: How receptive will students be to computer conference delivered training: How is effective participation defined online and what participation requirements, if any, are necessary to create a successful learning environment online: What level of formality and degree of structure is useful: What kind of community development or social life is required to support training through computer conference? Exploring these questions about online process and observation provided guidance to those working to develop effective online instruction. 10 refs.

27767 (FNAL/C–89/51) **Data acquisition, event building, and on-line processing: Summary talk.** Gaines, I. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 7p. DOE Contract AC02-76CH03000. (CONF-8901118–1: Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider, Toronto, CA, January 16, 1989). Order Number DE89011085/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Our subgroup of working group 4 concerned itself with general architectural issues for SSC data acquisition. Fiber optic buses were described in two talks, and software and project management were discussed in a separate subgroup. These topics are covered in separate papers. A number of different issues were considered with certain natural difference of opinion, and a list of projects needing further R and D is given at the end of this paper. The major conclusion, however, can be simply states and was agreed to unanimously: that the SSC data acquisition systems can achieve much higher data rates than those assumed at previous workshops. Online processor farms of 10^5 VAX equivalents (throughout this paper we will use VAX 11/780 units as a performance standard) are quite conceivable, and data recording rates of between 100 and 1000 Hz will be feasible. 2 figs.

27768 (JINR–R-10-88-321) **Test statistic w_n^3 in the theory of nonparametric goodness-of-fit criteria.** Zrelov, P.V.; Ivanov, V.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 12p. (In Russian). Order Number DE88706329/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The new w_n^3-statistics presented as an integral of the third degree of on empirical process is proposed. The mean value and deviation of the w_n^3-distribution are calculated. The algebraic form of the w_n^3-statistics to be convenient for practical use is obtained. By numerical calculations it was found out that the excess of the w_n^3-distribution is positive and the distribution has a symmetrical form. The percentage points of the w_n^3-distribution for small sample sizes n=1,2,...,9 are presented in tabulated form. The form of the empirical density of the w_n^3-distribution for n=1, 2 and 9 is given. 15 refs.; 1 fig.; 1 tab.

27769 (K/DSRD–71) **NALDA [Naval Aviation Logistics Data Analysis] CAI prototype: Phase 2, Final report.** Handler, B.H.; Bryant, R.A.; Twitty, A.F.; Duncan, L.D.; Hallbick, A.M.; Alvaro, D.R.; Voorhees, V.M.; Moeller, J.D. Oak Ridge Gaseous Diffusion Plant, TN (USA). Mar 1989. 310p. DOE Contract AC05-84OT21400. Order Number DE89010831/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

Data Systems Engineering Organization (DSEO) personnel developed a prototype computer aided instruction (CAI) system for the Naval Aviation Logistics Data Analysis (NALDA) system. The objective of this project was to provide a prototype for implementing CAI as an enhancement to existing NALDA training. The CAI prototype project is being performed in phases. The task undertaken in Phase I was to analyze the problem and the alternative solutions and to develop a set of recommendations on how best to proceed. In Phase II, a structured design and specification document was developed and a prototype CAI system was created according to the standards set forth in the document, Phase II Interim Report: Design Specifications for NALDA CAI (Twitty et al., 1987). This final report documents findings and results of Phase II. It includes a data dictionary, standards, special function key definitions, a curriculum description, program generator requirements and model programs, and installation procedures developed for the NALDA CAI Prototype. 52 refs., 57 figs.

27770 (LA-UR–89-861) **How to write application code even a security auditor could love.** Barlich, G.L. Los Alamos National Lab., NM (USA). 1989. 5p. DOE Contract W-7405-ENG-36. (CONF-890590–5: DOE computer security conference, Amarillo, TX, US,

May 2, 1989). Order Number DE89009390/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the past the application programmer was frequently isolated from the computer security professional. The target machine might have various access controls and security plans, but when the programmer delivered a new application, it was rarely scrutinized from a security standpoint. Security reviews of application code are now being used to overcome this apparent oversight, but these reviews are often hampered by a lack of knowledge among programmers of techniques that make code secure and facilitate security analysis of the code. This paper informally describes fifteen general principles for producing good code that is easily reviewed. This paper is not a formal guideline, but is intended as an inside view of how one reviewer looks at code from a security standpoint.

27771 Universal null DTE [data terminal equipment]. George, M.; Pierson, L.G.; Wilkins, M.E. To Dept. of Energy. USA Patent Application 7-118,075. 9 Nov 1987. 29p. DOE Contract AC04-76DP00789. Order Number DE89010949/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A communication device in the form of data terminal equipment permits two data communication equipments, each having its own master clock and operating at substantially the same nominal clock rate, to communicate with each other in a multi-segment circuit configuration of a general communication network even when phase or frequency errors exist between the two clocks. Data transmitted between communication equipments of two segments of the communication network is buffered. A variable buffer fill circuit is provided to fill the buffer to a selectable extent prior to initiation of data output clocking. Selection switches are provided to select the degree of buffer preload. A dynamic buffer fill circuit may be incorporated for automatically selecting the buffer fill level as a function of the difference in clock frequencies of the two equipments. Controllable alarm circuitry is provided for selectively generating an underflow or an overflow alarm to one or both of the communicating equipments. 5 figs.

27772 Interconnection networks. Faber, V.; Moore, J.W. To Dept. of Energy. USA Patent Application 7-209,238. 20 Jun 1988. 34p. DOE Contract W-7405-ENG-36. Order Number DE89010965/JAW. Available from NTIS, PC A03 - OSTI.

A network of interconnected processors is formed from a vertex symmetric graph selected from graphs $\Gamma_d(k)$ with degree d, diameter k, and $(d+1)!/(d-k+1)!$ processors for each $d \geq k$ and $\Gamma_d(k, -1)$ with degree $d-1$, diameter $k+1$, and $(d+1)!/(d-k+1)!$ processors for each $d \geq k \geq 4$. Each processor has an address formed by one of the permutations from a predetermined sequence of letters chosen a selected number of letters at a time, and an extended address formed by appending to the address the remaining ones of the predetermined sequence of letters. A plurality of transmission channels is provided from each of the processors, where each processor has one less channel than the selected number of letters forming the sequence. Where a network $\Gamma_d(k, -1)$ is provided, no processor has a channel connected to form an edge in a direction δ_1. Each of the channels has an identification number selected from the sequence of letters and connected from a first processor having a first extended address to a second processor having a second address formed from a second extended address defined by moving to the front of the first extended address the letter found in the position within the first extended address defined by the channel identification number. The second address is then formed by selecting the first elements of the second extended address corresponding to the selected number used to form the address permutations. 9 figs.

27773 (PB–89-858955/XAB) **Petri Nets for parallel processing and concurrent systems. January 1975-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 189p. Available from NTIS PC N01/MF N01.

Supersedes PB–88-862339.

This bibliography contains citations concerning principles and properties of Petri Nets and their uses and interpretation in modeling and simulating a wide variety of concurrent systems as well as their implementation in parallel processing. Control, verification, and validation concepts by Petri Nets are also considered. (This updated bibliography contains 335 citations, 115 of which are new entries to the previous edition.)

27774 (SAND–88-1615C) **Culture shock: Improving software quality.** de Jong, K.; Trauth, S.L. Sandia National Labs., Albuquerque, NM (USA). 1988. 6p. DOE Contract AC04-76DP00789. (CONF-890538–2: Quality congress of the American Society for Quality Control, Toronto, CA, May 8, 1989). Order Number DE89003610/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The concept of software quality can represent a significant shock to an individual who has been developing software for many years and who believes he or she has been doing a high quality job. The very idea that software includes lines of code and associated documentation is foreign and difficult to grasp, at best. Implementation of a software quality program hinges on the concept that software is a product whose quality needs improving. When this idea is introduced into a technical community that is largely "self-taught" and has been producing "good" software for some time, a fundamental understanding of the concepts associated with software is often weak. Software developers can react as if to say, "What are you talking about? What do you mean I'm not doing a good job? I haven't gotten any complaints about my code yet!" Coupling such surprise and resentment with the shock that software really is a product and software quality concepts do exist, can fuel the volatility of these emotions. In this paper, we demonstrate that the concept of software quality can indeed pose a culture shock to developers. We also show that a "typical" quality assurance approach, that of imposing a standard and providing inspectors and auditors to assure its adherence, contributes to this shock and detracts from the very goal the approach should achieve. We offer an alternative, adopted through experience, to implement a software quality program: cooperative assistance. We show how cooperation, education, consultation and friendly assistance can overcome this culture shock. 3 refs.

27775 (SAND–88-2668C) **The ϵ dataflow processor.** Grafe, V.G.; Davidson, G.S.; Hoch, J.E.; Holmes, V.P. Sandia National Labs., Albuquerque, NM (USA). 1988. 13p. DOE Contract AC04-76DP00789. (CONF-890537–1: 16. annual international symposium on computer architecture, Jerusalem, IL, May 28, 1989). Order Number DE89001679/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The ϵ dataflow architecture is designed for high speed uniprocessor execution as well as for parallel processing. The ϵ architecture directly matches ready operands, thus eliminating the need for associative matching stores. ϵ also supports low cost data fan out and critical sections. A 10 MFLOPS CMOS/TTL processor prototype is running and its performance has been measured with several benchmarks. The prototype processor has demonstrated sustained performance exceeding that of comparable control flow processors running at higher clock rates (three times faster than a 20 MHz transputer and 24 times faster than a Sun on a suite of arithmetic tests, for example). 22 refs., 16 figs.

27776 (SAND–88-3042C) **Computer media security considerations: DOE Order 5635.1A and DOE Order 5637.1.** Clever, J.J. Sandia National Labs., Albuquerque, NM (USA). 1988. 16p. DOE Contract AC04-76DP00789. (CONF-890590–1: DOE computer security conference, Amarillo, TX, US, May 2, 1989). Order Number DE89006326/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper suggests that the examples for marking computer and word processing media and the written specifications for marking word processing media, contained in Chapter III, DOE Order 5635.1A, are technically incorrect. SNLA study indicates that strict compliance can lead to damage to the computer media drive and/or media itself. A model for technically appropriate marking is recommended which would facilitate longer distance visual identification of sensitive media, allow proper human readable identification of the classification levels, categories, special access/handling, and accountability/control data as applicable to the specific media. A diskette labeling example is provided which will meet the model requirements and which will not adversely act to cause damage to either the computer drive or the media. 5 refs., 15 figs.

27777 (SAND–88-3054C) **A classified LAVC [Local Area VAXcluster] with distributed diskless workstations (CLAVC/DDW).** Haaker, C.K.; O'Malley, M.L. Sandia National Labs., Albuquerque, NM (USA). 1988. 6p. DOE Contract AC04-76DP00789. (CONF-890590–3: DOE computer security conference, Amarillo, TX, US, May 2, 1989). Order Number DE89007583/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It appears to be possible to set up VAX/VMS workstations in a Local Area VAXcluster (LAVC) configuration such that these workstations can be used to process classified information, and yet remain outside of a vault. If approved by the DOE, this configuration will enable staff to take advantage of the multiwindow, graphics, and batch processing capabilities of VMS workstations ("VAXstations") without having to leave their office areas, thus increasing their productivity.

27778 (SAND–88-3184C) **Security labeling in TCP/IP networks.** Brown, C.D. Sandia National Labs., Albuquerque, NM (USA). 30 Jan 1989. 7p. DOE Contract AC04-76DP00789. (CONF-890590–2: DOE computer security conference, Amarillo, TX, US, May 2, 1989). Order Number DE89007143/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

TCP/IP is the name commonly used to refer to a suite of networking protocols that was originally developed under the auspices of the Department of Defense for use on the Arpanet. These protocols are in wide use today on a large number of networks and have become accepted as a de facto industry standard. The Transmission Control Protocol (TCP) occupies the transport layer in the protocol suite, and the Internet Protocol (IP) occupies the network layer. In addition, there are a wide variety of other protocols in the DDN protocol suite. For example, the Unreliable Datagram Protocol (UDP) is alternative transport layer protocol that provides a simple unreliable datagram (packet) delivery service and uses the services of IP. The File Transport Protocol (FTP) and TELNET are application layer protocols that provide for file transfers and interactive logins, respectively, across a network using the services of TCP and IP. In this paper, we will discuss security labeling in a TCP/IP network with emphasis on the attempts to standardize labels at the IP layer; however, we will also discuss some of the issues relating to application protocols and privileged server processes in host computer systems. 4 refs., 1 fig.

27779 (UCRL–96080-Rev.2) **Layering central authentication on existing distributed system terminal services: Revision 2.** Nessett, D.M. Lawrence Livermore National Lab., CA (USA). 25 Oct 1988. 13p. DOE Contract W-7405-ENG-48. (CONF-890536–1-Rev.2: Symposium on security and privacy, Oakland, CA, US, May 1, 1989). Order Number DE89001814/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Provision of terminal service in a distributed system requires mechanisms to logon and logoff as well as to move textual data between the terminal and remote host. Logon occurs in most distributed systems subsequent to the establishment of a terminal session by means of host specific logon procedures. However, in a distributed system of any size, this approach leads to security and password management problems. When the distributed system is centrally administered, these problems can be rectified through the use of a central authentication service that presents a common logon interface to the user for all distributed system hosts. Normally, central authentication is provided by either initially designing it into a distributed system or supporting it through the modification of distributed system and host operating system software. As an alternative strategy, central authentication can be layered onto existing terminal services. This approach suggests itself when a large installed base of computer systems that do not support central authentication already exists. Work to assess the feasibility of this approach was carried out. The results demonstrate that layering can be used in certain circumstances to provide central authentication services, although, as a result, the concomitant maintenance costs may increase. It was also determined what terminal service features are necessary so that central authentication is easily layered on existing terminal services. Recommendations are made concerning how to structure terminal services in a distributed system to support an integrated central authentication service. 15 refs., 5 figs.

27780 (UCRL–96080-Rev.3) **Layering central authentication on existing distributed system terminal services: Revision 3.** Nessett, D.M. Lawrence Livermore National Lab., CA (USA). 17 Jan 1989. 10p. DOE Contract W-7405-ENG-48. (CONF-890536–1-Rev.3: Symposium on security and privacy, Oakland, CA, US, May 1, 1989). Order Number DE89006283/JAW. Available from NTIS, PC A02 - OSTI.

Logon in distributed systems can be accomplished in various ways. One technique, known as central authentication, is advantageous with respect to its excellent security properties. Normally, central authentication is provided by either initially designing it into a distributed system or supporting it through the modification of distributed system and the host operating system software. As an alternative strategy, central authentication can be layered onto existing terminal services. This approach suggests itself when a large installed base of computer systems that do not support central authentication already exists. Work to assess the feasibility of this approach was carried out. The results demonstrate that layering can be used in certain circumstances to provide central authentication services, although, as a result, the concomitant maintenance costs may increase. It was also determined what terminal service features are necessary so that central authentication is easily layered over existing terminal services. Recommendations are made concerning how to structure terminal services in a distributed system to support an integrated central authentication service. 13 refs., 5 figs.

27781 (UCRL–99303) **A Radon transform computer for multidimensional signal processing.** Azevedo, S.G.; Brase, J.M.; Martz, H.E.; Jain, A.K.; Current, K.W.; Hurst, P.J. Lawrence Livermore National Lab., CA (USA). 29 Dec 1988. 9p. DOE Contract W-7405-ENG-48. (CONF-890570–2: International conference on acoustics, speech and signal processing, Glasgow, GB, May 23, 1989). Order Number DE89006196/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A high-speed Radon transform computer (RTC) has been designed and simulated that operates the principles of the Parallel Projection Pipeline Engine (PPPE) processor suggested by Sanz, et al.. The computer consists of an array of identical processing elements with fast communication links to each of its neighbors and uses forward- and back-projection formulas using linear interpolation. Simulation and experimental timing results have been performed on both a systolic array of 64 Transputer processors and on arrays of commercial DSP chips. A custom VLSI implementation is currently under design which is expected to perform forward and inverse transforms of 512 by 512 images at or near video rates. 9 refs., 1 fig., 1 tab.

27782 (UCRL–100052) **Computer security is out of balance.** Bush, G.; Brand, R. Lawrence Livermore National Lab., CA (USA). 31 Jan 1989. 11p. DOE Contract W-7405-ENG-48. (CONF-890590–4: DOE computer security conference, Amarillo, TX, US, May 2, 1989). Order Number DE89008041/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

System Engineering practices are being applied to Computer Security, but not broadly enough. If we concentrate on only the computer security aspects in our field of computer security, then our focus may be too narrow, and consequently be out of balance. We must examine the complete system that includes the computers, the users, and their environment on the broadest scale possible. As an example of the problem in balance of emphasis, the work being done on Trusted Computer Bases is excellent, but is easily nullified by indifferent users. Our business is the search for weakest links, but that search cannot focus exclusively on just the part of the system that includes the computers. The dambuilding platitude is also relevant to this issue of focus, when the left side team builds their side of the dam higher than the right side team, no additional security (water) is realized. All parts and security programs must be in balance to be effective. 7 refs.

27783 **IEEE P1596, a scalable coherent interface for GigaByte/sec multiprocessor applications.** Gustavson, D.B. (Stanford Linear Accelerator Center, Stanford, CA (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science (USA),* 36(1): 811-812 (Feb 1989). (CONF-881103–: IEEE nuclear science symposium, Orlando, FL, US, November 9, 1988).

IEEE P159, the Scalable Coherent Interface (formerly known as SuperBus) is based on experience gained during the development of Fastbus (IEEE 960), Futurebus (IEEE 896.1) and other modern 32-bit buses. SCI goals include a minimum bandwidth of 1 GByte/sec per processor, efficient support of a coherent distributed-cache image of shared memory; and support for segmentation, bus repeaters and general switched interconnections like Banyan, Omega, or full crossbar networks. To achieve these ambitious goals, SCI must sacrifice the immediate handshake characteristic of the present generation of buses in favor of a packet-like split-cycle protocol. Wire-ORs, broadcasts, and even ordinary passive bus structures are to be avoided. However, a lower performance (1 GByte/sec per backplane instead of per processor) implementation using a register insertion ring architecture on a passive backplane appears to be possible using the same interface as for the more costly switch networks. This paper presents a summary of current directions, and reports the status of the work in progress.

9903 Information Handling

Refer also to citation(s) 26301, 26442, 26482, 26512, 26525, 26528, 26837, 26902, 27114, 27115, 27168, 27652, 27752, 27754, 27755, 27758, 27763

27784 (AOSTRA–1987) **Alberta oil sands index. Glossary.** Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). [1989]. 91p. (CE–02461). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This glossary is a list of keywords used in the Alberta Oil Sands Index (AOSI), including a definition or statement of how the keyword is used for most terms. For this index, it is understood that oil sands consists of bitumen impregnated sands, often called tar sand, bituminous sand, carbonaceous rock, or oil-impregnated rock. The index contains all published information on oil sands, indexed by keywords, categories and weights. Descriptions are given of the subject categories used and the weight system.

27785 (DOE/DP/70033–3) **Research and development of models and instruments to define, measure, and improve shared information processing within government oversight agencies: Volume 1, 3rd annual performance report: Research status, August 1988–July 1989.** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Management Systems Labs. 1989. 150p. DOE Contract FG05-86DP70033. Order Number DE89010595/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

More than ever before, government managers must effectively and efficiently direct and coordinate the sharing of data, information, and the complex of people and machines that create it, store it, retrieve it, manipulate it, and convert it into actions to move the country's business decisively forward. Driving this need to share is a stunning technological capacity for automated processing, a deep-rooted desire to share born from a perception seemingly limitless possibilities, and a fiscal requirement to do better with less by making more out of what we have. Unfortunately, the shared information processing benefits Government Oversight Agencies (GOA's) need are not available just for the asking or for the cost of the equipment. This frustrates the manager who thinks the box on the desk should help with decision support as well as it helps with task automation. To move GOA's toward successful shared information processing and decision mechanisms, Management Systems Laboratories (MSL), under the grant, plans to accomplish the following two-part objectives: to use the real-world laboratory of the US Department of Energy (DOE) Office of Nuclear Materials (ONM) as a generic test to observe, define, characterize, and qualitatively model the shared information processing in a GOA; and then to develop qualitative and quantitative instruments to measure, evaluate and promote the psychological, sociological, and technological dimensions of successful sharing.

27786 (EFI-TR–3518) **Introduction to ELCOM. A power utility oriented data communication system.** Conrad, R.; Eggen, N.; Grytting, T.; Hegge, J.; Magnus, H.; Tannlund, P.; Torkilseng, Aa. Elektrisitetsforsyningens Forskningsinstitutt, Trondheim (Norway). Jun 1988. 58p. Order Number DE88757295/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The power utility oriented data communication system ELCOM was developed to meet the need to communicate in a hierarcical process control system, which consists of both hardware (computers) and software from different manufacturers. The ISO Open Systems Interconnection Reference Model formed the basis for the ELCOM protocols. One of the main advantages of ELCOM is an easy and effective way of identifying data. A data element may be identified by an object identifier. ELCOM is delivered with a subroutine library, which can be called from high level languages. The ELCOM system has been thoroughly tested by the Norwegian Power Pool in cooperation with major suppliers of control centre on the Norwegian market. Four different computer brands were inwolved. 4 refs., 6 figs., 3 tabs.

27787 (INIS-SU–77/A, pp. 322-336) **Requirements in nuclear data in the nuclear geophysics and adjoining fields.** Polyachenko, A.L. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow (USSR)); Trukhanov, G.Ya. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The requirements to accuracy and completeness of nuclear data for nonenergetic applications: nuclear geophysics, biomedicine, problems of radiation transport in Earth's atmosphere etc are considered. 40 refs.

27788 (INIS-SU–77/A, pp. 337-341) **Recommended reference data for some non-power engineering applications.** Trukhanov, G.Ya. (Gosudarstvennyj Komitet Standartov Soveta Ministrov SSSR, Moscow (USSR)); Vozyakov, V.V.; Mekhtiev, U.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, SU, September 21, 1987). In *Neutron physics. Vol. 1.* Order Number DE89780087/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

The problem of the developing of the recommended reference data for the nonpower applications is discussed. 13 refs.

27789 (JINR–R-5-88-221) **Efficient estimator of parameters and goodness-of-fit test of multivariate distributions for data presented by one-dimensional histograms.** Chernov, N.I.; Kurbatov, V.S.; Ososkov, G.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 10p. (In Russian). Order Number DE88706318/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Submitted to the journal Nucl. Insrum. Methods.

The problem of estimation of multi-dimensional distribution parameters in the case when the experimental information is presented by one-dimensional histograms is investigated. The parameter estimation method and the goodness-of-fit test generalizing the well-known chi^2 one are proposed. The expression for covariance matrix is obtained. The asymptotic efficiency of the proposed method is proved. 5 refs.; 2 figs.

27790 (SAND–88-3062C) **Study of methods for the enhancement of classified document control and protection.** Tucker, M.D. Sandia National Labs., Albuquerque, NM (USA). 1988. 8p. DOE Contract AC04-76DP00789. (CONF-890591–1: Carnahan conference on security technology, Lexington, KY, US, May 16, 1989). Order Number DE89006767/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For many years, the protection of classified documents has been a concern of administrative and management personnel. Recent thefts of documents has increased this concern and has led to high level committee investigations into improved classified document protection techniques. Better methods must be found to improve

classified document control and protection systems. From preliminary investigations, it was determined that there is not one technique or method that alone would provide adequate protection of classified documents. Thus, it was decided to break the problem into smaller parts and to propose a systematic approach that would utilize several components to increase the protection of classified documents. These components would limit the unauthorized access to classified documents, increase the protection of documents during transfers between accountability stations, protect documents against unauthorized reproduction, protect classified documents against the unauthorized removal from a secured area, and verify that documents that have been flagged for destruction are actually physically destroyed. This study investigates techniques that could be implemented in each of these five areas and then how these techniques can be combined to develop a classified document protection system. 12 refs., 5 tabs.

27791 (SAND–88-3150C) **Optical information storage in PLZT thin films.** Land, C.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 26p. DOE Contract AC04-76DP00789. (CONF-890421–3: 91. annual meeting of the American Ceramic Society, Indianapolis, IN, US, April 23, 1989). Order Number DE89011067/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The feasibility of storing and reading high density optical information in lead zirconate titanate (PZT) and in lead lanthanum zirconate titanate (PLZT) thin films depends on both the longitudinal electrooptic coefficients and the photosensitivities of the films. This paper describes the methods used to measure both the longitudinal electrooptic effects and the photosensitivities of the thin films. The results of these measurements were used to evaluate a longitudinal quadratic electrooptic R coefficient, a linear electrooptic r_c coefficient and the wavelength dependence of the photosensitivity of a composition of PZT polycrystalline thin film. The longitudinal electrooptic R and r_c coefficients are about an order of magnitude less than the transverse R and R_c coefficients of the bulk ceramics of similar compositions. This is attributed to clamping of the film by the rigid substrate. The large birefringence after poling ($>10^{-2}$) suggests that the optic axes of the films are preferentially oriented normal to the film surface. The techniques used for evaluating the photosensitivities of the thin films are based on measuring the photocurrent generated rather than the reduction in coercive voltage (used previously for bulk ceramics) when the film is exposed to light. The thin film photosensitivities appear to be about three orders of magnitude higher than those of bulk ceramics of similar compositions. 14 refs., 12 figs., 1 tab.

9905 Civilian Defense

Refer also to citation(s) 26396

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

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202885/0/XAB	14:27172	NTIS, PC A08/MF A01			ND-00
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203173/0/XAB	14:26781	NTIS, PC A03/MF A01			ND-00
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203392/6/XAB	14:27756	NTIS, PC A03/MF A01			ND-00
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203900/6/XAB	14:26684	NTIS, PC A10/MF A01			ND-00
AE/SESR–					
1-260	14:26655	Alberta Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:26202	Alberta. Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:26656	Alberta. Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:26685	Dept. of Energy, Petroleum Plaza Twr., 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
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87-0334	14:27513	*See* AD-A-202432/1/XAB			

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AFIT/GAE/AA–					
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88D-28	14:26779	*See* AD-A–202705/0/XAB			
88D-30	14:26727	*See* AD-A–202652/4/XAB			
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88D-3	14:27751	*See* AD-A–202657/3/XAB			
88D-12	14:27056	*See* AD-A–203046/8/XAB			
AFIT/GE/ENG–					
88D-42	14:26759	*See* AD-A–202598/9/XAB			
AFIT/GEP/ENP–					
88D-1	14:26778	*See* AD-A–202596/3/XAB			
AFIT/GSO/ENP–					
88D-8	14:27343	*See* AD-A–202653/2/XAB			
AFRRI-SR–					
88-21	14:27203	*See* AD-A–202516/1/XAB			
88-22	14:27202	*See* AD-A–202515/3/XAB			
88-26	14:27204	*See* AD-A–202971/8/XAB			
88-27	14:27207	*See* AD-A–203085/6/XAB			
88-28	14:27206	*See* AD-A–203084/9/XAB			
AGA–					
9010603	14:27039	American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 $50.00			ND-000
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1988	14:27332	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
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ARI-RR–					
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AU-AWC–					
88-146	14:26722	*See* AD-A–202639/1/XAB			
88-161	14:27051	*See* AD-A–202771/2/XAB			
BAT–					
8874-927001	14:26748	*See* N–89-16041			
BCMAF/FR–					
8804	14:26277	British Columbia. Ministry of Agriculture and Fisheries, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCMEMPR–					
1987	14:26282	Petroleum Resources Division, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $40.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

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1987	14:27066	British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
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593	14:27724	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89609823/JAW	MF-000
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607	14:27662	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610517/JAW	MF-000
BMI–					
2162	14:26395	*See* NUREG/CR–5081			
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BMU–					
1988-202	14:26733	GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			ND-000
BNL–					
41464	14:26940	NTIS, PC A02 - OSTI		DE89011250/JAW	MF-414
42339	14:26387	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010495/JAW	MF-721
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52194	14:27067	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010273/JAW	PC-402
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52174	14:26591	*See* NUREG/CR–5261			
52179	14:26360	*See* NUREG/CR–5279			
52193	14:26592	*See* NUREG/CR–5355			
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06-89	14:26613	*See* PB–89-148423/XAB			
BUMINES-RI–					
9211	14:26750	*See* PB–89-159784/XAB			
9218	14:26233	*See* PB–89-159800/XAB			
CANMET–					
MRL-88-33-TR	14:26420	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
PMRL-86-11-TR	14:26734	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
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02102	14:26599	*See* EMR–1981			
02410	14:26287	*See* NEB-SS–8808			
02412	14:26288	*See* NEB-SS–8809			
02446	14:26676	*See* DE–8208			
02461	14:27784	*See* AOSTRA–1987			
02462	14:26301	*See* AOSTRA–1986			
02468	14:26300	*See* AOSTRA–26			
02471	14:26262	*See* PRI–1981-1			
02472	14:26620	*See* ORF/ES–8006			
02481	14:27341	*See* MU/CCORE–1987			
02485	14:26303	*See* AOSTRA–8104			
02495	14:27040	*See* CU–C-154			
02497	14:26448	*See* SNC–C-118			

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02500	14:26441	*See* FERIC–SR-16			
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02530	14:26638	*See* ESSA/T–320-U-564			
02539	14:26860	*See* CMG–R4-01			
02543	14:26637	*See* ERCB–ST87-27			
02544	14:26707	*See* MLA–11553			
02545	14:26616	*See* A/ENR–7803			
02554	14:26713	*See* SAE–1944-1-1-1			
02556	14:26621	*See* SAE–1944-1-1-1			
02560	14:26914	*See* SC/M–C-3			
02561	14:26681	*See* ACERR–U17			
02562	14:26714	*See* CRC–1977			
02563	14:27332	*See* AI–1988			
02564	14:26442	*See* IEACG–1987			
02566	14:26425	*See* IEC–1987			
02567	14:26426	*See* IEC–1987			
02571	14:26701	*See* OAF/AED–88-6116			
02572	14:26700	*See* OAF/AE–290-731			
02573	14:26667	*See* OAF/AE–774-42			
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02577	14:26702	*See* OAF/AED–88-6507			
02578	14:26699	*See* OAF/AE–261-717			
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9696	14:26516	NTIS (US Sales Only), PC A03/MF A01		DE89764001/JAW	MF-000
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9753	14:26762	NTIS (US Sales Only), PC A02/MF A01		DE89763996/JAW	MF-000
CEBAF-PR–					
89-001	14:26920	*See* DOE/ER/40150–59			
CERL-TR-E–					
89/04	14:26654	*See* AD-A–203143/3/XAB			
CESAR–					
89/14	14:27760	*See* CONF-8905109–1			
CIPEC–					
88091888	14:26686	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C.			ND-000
88091888F	14:26687	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C.			ND-000
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862310-2	14:26264	NTIS (US Sales Only), PC A04/MF A01		DE88757289/JAW	MF-000
CONCAWE–					
7/88	14:27319	*See* PB–89-145346/XAB			
CONF-8006281–		(13. meeting of the WG for environmental, health and nutrition aspects of animal production; Celle, DE; June 12, 1980)			
1	14:26434	*See* DLG–538010			
CONF-850181–		(Seminar on control of peat production; Jyvaeskylae, FI; January 16, 1985)			
	14:26234	*See* VTT-SYMP–59			
CONF-8510489–		(98. annual meeting of the Geological Society of America; Orlando, FL, US; October 28, 1985)			
	14:26384				
	14:27338				
	14:27340				
	14:27342				
CONF-851115–		(American Nuclear Society winter meeting; San Francisco, CA, US; November 10, 1985)			
55	14:26510	*See* HEDL-SA–3324			

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CONF-870511–		(4. international hazardous waste symposium on environmental aspects of stabilization-solidification of hazardous and radioactive wastes; Atlanta, GA, US; May 3, 1987)			
6	14:26322	*See* BNL–42563			
CONF-870601–		(Annual meeting of the American Nuclear Society; Dallas, TX, US; June 7, 1987)			
24	14:26578	*See* HEDL-SA–3651			
CONF-8706186–		(ASME applied mechanics, bioengineering and fluid engineering conference; Cincinnati, OH, US; June 14, 1987)			
	14:26804	American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017			
CONF-8706388–		(10. All-Union seminar on linear accelerators; Kharkov, UA; June 2, 1987)			
	14:26918	*See* INIS-SU–79			
CONF-8706389–		(Regional workshop on isotope hydrology for Asia and the Pacific; Beijing, CN; June 15, 1987)			
	14:27162	*See* INIS-mf–11357			
CONF-8707139–		(4. black liquor research program review meeting; Gaithersburg, MD, US; July 28, 1987)			
	14:26688	NTIS, PC A18/MF A01 - OSTI	E 1.99:	DE88004597/JAW	PC-310
CONF-8707212–		(Biological treatment of coals workshop; Vienna, VA, US; July 8, 1987)			
	14:26203	NTIS, PC A20/MF A01 - OSTI	E 1.99:	DE89010545/JAW	MF-102
CONF-8708269–		(10. European regional astronomy meeting of the IAU; Prague, CS; August 24, 1987)			
	14:27390	*See* INIS-mf–11400			
	14:27415	*See* INIS-mf–11401			
CONF-870837–		(13. American Nuclear Society international meeting on nuclear power plant operation; Chicago, IL, US; August 30, 1987)			
	14:26522				
	14:26545				
	14:26546				
	14:26547				
CONF-870856–		(Conference on nondestructive testing of high performance ceramics; Boston, MA, US; August 25, 1987)			
5	14:26764	*See* EGG-M–10087			
CONF-870917–		(ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation; Richland, WA, US; September 13, 1987)			
11	14:26594	*See* WHC-SA–0046			
12	14:26579	*See* HEDL-SA–3717			
CONF-870959–		(1. international conference on neutron physics; Kiev, SU; September 21, 1987)			
	14:27630	*See* INIS-SU–77/A			
CONF-871007–		(12. symposium on fusion engineering; Monterey, CA, US; October 12, 1987)			
138	14:27726	*See* EGG-M–13887			
CONF-8710101–		(31. annual Human Factors Society meeting; New York, NY, US; October 19, 1987)			
2	14:27766	*See* EGG-M–19687			
CONF-871109–		(International conference on waste management; Hong Kong, HK; November 30, 1987)			
1	14:26876	*See* EGG-M–14987			
CONF-8711195–		(American Nuclear Society winter meeting; Los Angeles, CA, US; November 15, 1987)			
5	14:26514	*See* WHC-SA–0091			
CONF-8711245–		(Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, IT; November 19, 1987)			
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CONF-880117–		(3. conference on hypercube concurrent computers and applications; Pasadena, CA, US; January 19, 1988)			
10	14:27758	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010911/JAW	MF-405
CONF-880354–		(Waste management '88; Tucson, AZ, US; March 1, 1988)			
11	14:26382	*See* WHC-SA–0104			
12	14:26346	*See* EGG-M–29587			
CONF-8804263–		(Eastern simulation conference; Orlando, FL, US; April 22, 1988)			
1	14:26575	*See* EGG-M–02288			
CONF-880463–		(8. symposium on turbulence and diffusion of the American Meterological Society; San Diego, CA, US; April 25, 1988)			
4	14:27129	*See* RFP–4335			
CONF-8805132–		(4. national conference on high power microwave (HPM) technology for defense applications; Monterey, CA, US; May 9, 1988)			
15	14:27049	*See* UCRL–97983			
CONF-8805150–		(4. international conference on neutron capture therapy; Bremen, DE; May 31, 1988)			
11	14:27185	*See* BNL–42522			
CONF-880589–		(International conference on oil shale and shale oil; Beijing, CN; May 16, 1988)			
	14:26302	NTIS, PC A99 - OSTI - Chemical Industry Press, Huaxue Gongye Chubanshe, 16 Lou, 7 Qu, Hepingli, Beijing, China		DE89010445/JAW	MF-123
CONF-8806348–		(6. seminar on industrial safety; Curitiba, BR; June 21, 1988)			
	14:27666	*See* INIS-BR–1469			
	14:27667	*See* INIS-BR–1470			
CONF-880695–		(1. European particle accelerator conference (EPAC-1); Rome, IT; June 7, 1988)			
71	14:26940	*See* BNL–41464			
CONF-880702–		(23. intersociety energy conversion engineering conference; Denver, CO, US; July 31, 1988)			
	14:26516	*See* CEA-CONF–9696			
	14:26517	*See* CEA-CONF–9697			
	14:26518	*See* CEA-CONF–9698			
CONF-880705–		(International conference on magnetism (ICM '88); Paris, FR; July 25, 1988)			
	14:26762	*See* CEA-CONF–9753			
CONF-880730–		(25. annual conference on nuclear and space radiation effects; Portland, OR, US; July 12, 1988)			
	14:26805				
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CONF-8808182–		(Heavy flavor physics symposium; Beijing, CN; August 10, 1988)			
4	14:27564	*See* LBL–26547			
CONF-8808219–		(6. international congress on quantum chemistry; Jerusalem, IL; August 21, 1988)			
1	14:26842	*See* LBL–25554			
CONF-880839–		(10. annual DOE low-level waste management conference; Denver, CO, US; August 30, 1988)			
15-Rev.1	14:26335	*See* DP-MS–87-172-Rev.1			

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CONF-880903–		(Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, US; September 11, 1988)			
50	14:26383	*See* WHC-SA–0218			
52	14:26357	*See* LBL–24803			
CONF-880911–		(International reactor physics conference; Jackson Hole, WY, US; September 18, 1988)			
34	14:26544	*See* WHC-SA–0280			
CONF-880912–		(196. American Chemical Society national meeting; Los Angeles, CA, US; September 25, 1988)			
29	14:27147	*See* LBL–26183			
CONF-8809323–		(Conference on new dimensions in pricing electricity; Syracuse, NY, US; September 28, 1988)			
	14:26636	*See* EPRI-CU–6300			
CONF-8809334–		(16. annual conference of the American Society for Quality Control and Energy; Ft. Lauderdale, FL, US; September 12, 1988)			
1	14:27747	*See* FNAL/C–89/36			
CONF-8809335–		(2. international symposium on annular and dispersed flows; Oxford, GB; September 6, 1988)			
1	14:27559	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010655/JAW	MF-406
CONF-8810155–		(16. water reactor safety information meeting; Gaithersburg, MD, US; October 24, 1988)			
Vol.2	14:26587	*See* NUREG/CP–0097-Vol.2			
Vol.3	14:26588	*See* NUREG/CP–0097-Vol.3			
Vol.4	14:26589	*See* NUREG/CP–0097-Vol.4			
CONF-8810182–		(International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, US; October 3, 1988)			
25	14:27653	*See* LA-UR–89-1402			
CONF-881020–		(4. international symposium on radiation physics; Sao Paulo, BR; October 3, 1988)			
	14:27617	*See* INIS-BR–1458			
CONF-8810255–		(International symposium on the electronic structure of High Tc superconductors; Rome, IT; October 5, 1988)			
	14:26766	*See* INFN-LNF–88-71(P)			
CONF-8810264–		(Conference on hadronic matter in collision; Tucson, AZ, US; October 6, 1988)			
12	14:27585	*See* LBL–26792			
CONF-8810296–		(Boulder damage symposium; Boulder, CO, US; October 26, 1988)			
5	14:26775	*See* PNL-SA–16187			
CONF-881031–		(8. topical meeting on technology of fusion energy; Salt Lake City, UT, US; October 9, 1988)			
69	14:27727	*See* EGG-M–88266			
CONF-8810333–		(International workshop on thermal field theories and their applications; Cleveland, OH, US; October 3, 1988)			
3	14:27567	*See* FNAL/C–88/188-A			
CONF-8810347–		(Governor's conference; Spokane, WA, US; October 7, 1988)			
1	14:26515	*See* WHC-SA–0422			
CONF-8810349–		(Outstanding Engineering Achievement Award meeting; Seattle, WA, US; October 1, 1988)			
1	14:26366	*See* PNL-SA–16327			
CONF-8810350–		(6. cooling tower workshop of the International Association for Hydraulic Research; Pisa, IT; October 4, 1988)			
	14:26529	*See* EPRI-GS–6317			
CONF-8810353–		(21. annual meeting of the European Society for Radiation Biology; Tel-Aviv, IL; October 24, 1988)			
	14:27216	*See* INIS-mf–11406			
CONF-8810355–		(Charite-symposium 'CT and MR in medicine'; Berlin, DD; October 17, 1988)			
	14:27190	*See* INIS-mf–11404			
CONF-881103–		(IEEE nuclear science symposium; Orlando, FL, US; November 9, 1988)			
	14:26595				
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	14:26912				
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	14:27783				
60	14:26971	*See* EGG-M–88171			
61	14:26973	*See* FNAL-TM–1573			
CONF-881115–		(3. international topical meeting on nuclear power plant thermal hydraulics and operations; Seoul, KR; November 14, 1988)			
6	14:26567	NTIS, PC A02 - OSTI		DE89009859/JAW	MF-523
CONF-8811175–		(Beyond the standard model; Ames, IA, US; November 18, 1988)			
4	14:27566	*See* FNAL/C–89-41-T			
CONF-8811180–		(Meeting of the Societe Francaise d'Energie Nucleaire (SFEN); Paris, FR; November 23, 1988)			
	14:26736	*See* CEA-CONF–9703			
CONF-881205–		(Gas, oil and coal biotechnology symposium; New Orleans, LA, US; December 5, 1988)			
2	14:26257	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011243/JAW	MF-122
CONF-881218–		(2. North American conference on preparing for climate change; Washington, DC, US; December 6, 1988)			
2	14:27070	*See* EGG-M–89011			
CONF-8901100–		(Solar Energy Research Institute (SERI) anaerobic digestion review meeting; Golden, CO, US; January 25, 1989)			
2	14:26404	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009821/JAW	MF-246
CONF-8901118–		(Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider; Toronto, CA; January 16, 1989)			
1	14:27767	*See* FNAL/C–89/51			
CONF-8901121–		(5. workshop on nuclear astrophysics; Tegernsee, DE; January 30, 1989)			
1	14:27503	*See* LBL–26895			
CONF-890113–		(High resolution nuclear magnetic resonance in solids; Cambridge, MA, US; January 19, 1989)			
1	14:27705	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011220/JAW	MF-411
CONF-890197–		(Advanced accelerator concepts workshop; Lake Arrowhead, CA, US; January 9, 1989)			
8	14:26938	*See* LA-UR–89-1230			
CONF-890199–		(8. Moriond workshop on tests of fundamental laws in physics; Les Arcs, FR; January, 1989)			
3	14:27563	*See* LA-UR–89-1173			
CONF-890207–		(Waste management '89; Tucson, AZ, US; February 26, 1989)			
26	14:26337	*See* DP-MS–88-188			
27	14:26336	*See* DP-MS–88-182			
28	14:26377	*See* SAND–89-0165C			

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CONF-890238–		(Annual meeting and exhibit of the Society of Mining Engineers, Inc.; Las Vegas, NV, US; February 27, 1989)			
3	14:26201	*See* DOE/PETC/TR–89/5			
CONF-890262–		(4. international conference on solving ground water problems with models; Indianapolis, IN, US; February 7, 1989)			
4	14:27136	*See* DP-MS–88-59			
CONF-890270–		(International industrial symposium on the super collider; New Orleans, LA, US; February 8, 1989)			
3	14:26941	*See* FNAL/C–89/53			
5	14:26942	*See* FNAL/C–89/55			
7	14:26948	*See* FNAL-TM–1582			
8	14:26947	*See* FNAL-TM–1581			
9	14:26946	*See* FNAL-TM–1580			
CONF-890297–		(IEEE nuclear science symposium; Orlando, FL, US; February 8, 1989)			
1	14:26972	*See* FNAL/C–89/25-E			
CONF-890304–		(3. ANS topical meeting on robotics and remote systems; Charleston, SC, US; March 13, 1989)			
	14:26871	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89010451/JAW	MF-706
CONF-8903100–		(9. U.S. compact toroid symposium; Union, WA, US; March 14, 1989)			
3	14:27723	*See* LA-UR–89-868			
CONF-8903109–		(5. international aluminum-lithium conference; Williamsburg, VA, US; March 28, 1989)			
1	14:26737	NTIS, PC A02 - OSTI		DE89010183/JAW	MF-503
CONF-890334–		(Spring conference of the American Society for Nondestructive Testing; Charlotte, NC, US; March 20, 1989)			
1	14:26903	*See* DP-MS–89-49			
CONF-890335–		(13. particle accelerator conference; Chicago, IL, US; March 20, 1989)			
74	14:26929	*See* FNAL/C–89/64			
75	14:26943	*See* FNAL/C–89/72			
89	14:26965	*See* LA-UR–89-1406			
90	14:26964	*See* LA-UR–89-1159			
CONF-890352–		(US Department of Energy research and development for the geothermal marketplace: 7th geothermal program review; San Francisco, CA, US; March 21, 1989)			
5	14:26460	*See* EGG-M–89092			
CONF-890360–		(7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989)			
3	14:26534	*See* CONF-890555–2			
CONF-890378–		(American Nuclear Society workshop on safety of uranium-aluminum fueled reactors; Idaho Falls, ID, US; March 15, 1989)			
7	14:26574	*See* DP-MS–89-47			
CONF-890384–		(IAEA technical committee meeting on H mode physics; Gut Ising, DE; March 20, 1989)			
3	14:27710	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011235/JAW	MF-420
CONF-890401–		(197. national meeting of the American Chemical Society; Dallas, TX, US; April 9, 1989)			
7	14:26323	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010701/JAW	MF-70
8	14:26240	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010697/JAW	MF-401
9	14:26338	*See* DP-MS–88-233			
CONF-890406–		(Fifty years with nuclear fission conference; Gaithersburg, MD, US; April 25, 1989)			
9	14:27592	*See* UCRL–99678			
10	14:27590	*See* UCRL–99663			
11	14:27591	*See* UCRL–99676			
12	14:27587	NTIS, PC A02 - OSTI		DE89010842/JAW	MF-413
CONF-8904111–		(Southeastcon '89 conference and exhibition; Columbia, SC, US; April 9, 1989)			
8	14:27765	*See* DP-MS–88-236			
CONF-8904121–		(Supercomputing and third world supercomputer exhibition; Santa Clara, CA, US; April 30, 1989)			
1	14:27561	*See* LA-UR–89-518			

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CONF-8904123–		(4. international conference on superconducting; Santa Clara, CA, US; April 30, 1989)			
1	14:27707	*See* UCRL–100604			
CONF-8904156–		(CSNI-CEC specialist meeting on trends and pattern analyses of operational data from nuclear power plants; Rome, IT; April 3, 1989)			
1	14:26528	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008929/JAW	MF-000
CONF-8904157–		(33. annual meeting of Ammunition Technology Division of the American Defense Preparedness Association; Albuquerque, NM, US; April 12, 1989)			
1	14:27052	*See* SAND–88-2800C			
CONF-8904181–		(40. anniversary symposium of the New Brunswick Laboratory; Argonne, IL, US; April 3, 1989)			
2	14:26806	NTIS, PC A03 - OSTI		DE89010844/JAW	MF-401
CONF-8904182–		(SCANNING '89/EM West; Long Beach, CA, US; April 5, 1989)			
2	14:26769	*See* LA-UR–89-1273			
CONF-8904197–		(The energy/chemistry conference; Cairo, EG; April 1, 1989)			
1	14:26424	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010695/JAW	MF-249
CONF-890421–		(91. annual meeting of the American Ceramic Society; Indianapolis, IN, US; April 23, 1989)			
3	14:27791	*See* SAND–88-3150C			
5	14:26776	*See* SAND–89-0951C			
CONF-890426–		(Spring meeting of the Materials Research Society; San Diego, CA, US; April 24, 1989)			
6	14:27704	*See* PNL-SA–16256			
CONF-890437–		(Corrosion '89; New Orleans, LA, US; April 17, 1989)			
11	14:26753	*See* PNL-SA–16311			
12	14:26754	*See* PNL-SA–16474			
CONF-890452–		(6. national conference and exhibition on hazardous wastes and hazardous materials; New Orleans, LA, US; April 12, 1989)			
1	14:27159	*See* PNL-SA–16365			
CONF-890466–		(13. symposium on aquatic toxicology and risk assessment; Atlanta, GA, US; April 16, 1989)			
1	14:27317	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010178/JAW	MF-402
CONF-890470–		(8. symposium on training of nuclear facility personnel; Gatlinburg, TN, US; April 23, 1989)			
	14:26309	NTIS, PC A99/MF A01 - OSTI	E 1.99:	DE89010164/JAW	MF-407
CONF-890482–		(Spring conference of the American Society for Nondestructive Testing; Charlotte, NC, US; March 20, 1989)			
2	14:26903	*See* DP-MS–89-49			
CONF-890488–		(4. international symposium on ceramics in nuclear waste management; Indianapolis, IN, US; April 23, 1989)			
2	14:26367	*See* PNL-SA–16491			
3	14:26370	*See* PNL-SA–16887			
4	14:26369	*See* PNL-SA–16871			
5	14:26368	*See* PNL-SA–16582			
CONF-8905100–		(International conference on measurement and modeling of computer systems; Berkeley, CA, US; May 23, 1989)			
1	14:27759	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89007841/JAW	MF-405
CONF-8905102–		(39. electronic components conference; Houston, TX, US; May 22, 1989)			
1	14:26756	*See* SAND–89-0401C			
CONF-8905103–		(2. annual ABAQUS users' conference; Stresa, IT; May 24, 1989)			
1	14:26316	*See* DP-MS–89-38			
CONF-8905104–		(Army symposium on solid mechanics: mechanics of engineered materials and applications; Newport, RI, US; May 16, 1989)			
1	14:26803	*See* UCRL–100133			
CONF-8905105–		(3. international conference on numerical combustion; Antibes, FR; May 23, 1989)			
1	14:26901	*See* LA-UR–89-590			

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CONF-8905107–		(SEM spring meeting; Cambridge, MA, US; May 28, 1989)			
1	14:26970	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89008235/JAW	MF-38
2	14:26755	*See* SAND–88-2447C			
CONF-8905109–		(Workshop on integration of AI and robotic systems; Scottsdale, AZ, US; May 19, 1989)			
1	14:27760	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89008743/JAW	MF-406
2	14:26874	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89008718/JAW	MF-406
CONF-8905112–		(ASTM symposium on the applications of automation technology to fatigue; Kansas City, MO, US; May 22, 1989)			
1	14:26904	*See* SAND–88-2183C			
CONF-8905115–		(2. international workshop on real-time computing of the environmental consequences of an accidental release to the atmosphere from a nuclear installation; Luxembourg, LU; May 16, 1989)			
1	14:27127	*See* LA-UR–89-1118			
CONF-8905118–		(2. international conference on trends on welding research; Gatlinburg, TN, US; May 15, 1989)			
1	14:26757	*See* UCRL–100776			
4	14:26739	*See* EGG-M–88512			
CONF-8905119–		(11. annual conference of the International Society of Parametric Analysts (ISPA); McLean, VA, US; May 8, 1989)			
1	14:27761	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009616/JAW	MF-700
CONF-8905120–		(8. topical conference on radio frequency power in plasmas; Irvine, CA, US; May 1, 1989)			
1	14:27714	*See* GA-A–19608			
CONF-890518–		(175. meeting of the Electrochemical Society; Los Angeles, CA, US; May 7, 1989)			
1	14:26746	*See* LBL–26508			
CONF-890522–		(International conference on robotics and automation; Scottsdale, AZ, US; May 14, 1989)			
4	14:26872	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89003119/JAW	MF-506
5	14:26873	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89002974/JAW	MF-406
CONF-890523–		(36. international technical communication conference; Chicago, IL, US; May 14, 1989)			
1	14:27746	*See* DP-MS–88-170			
CONF-890530–		(3. international congress of the International Council on Applied Mineralogy; Montreal, CA; May 14, 1989)			
1	14:27749	*See* K/QT–210			
CONF-890535–		(36. international technical communication conference; Chicago, IL, US; May 14, 1989)			
1	14:27750	*See* UCRL–99538			
CONF-890536–		(Symposium on security and privacy; Oakland, CA, US; May 1, 1989)			
1-Rev.2	14:27779	*See* UCRL–96080-Rev.2			
1-Rev.3	14:27780	*See* UCRL–96080-Rev.3			
CONF-890537–		(16. annual international symposium on computer architecture; Jerusalem, IL; May 28, 1989)			
1	14:27775	*See* SAND–88-2668C			
CONF-890538–		(Quality congress of the American Society for Quality Control; Toronto, CA; May 8, 1989)			
2	14:27774	*See* SAND–88-1615C			
CONF-890545–		(6. conference on real-time computer applications in nuclear, particle and plasma physics; Williamsburg, VA, US; May 15, 1989)			
1	14:27711	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89007820/JAW	MF-420
CONF-890546–		(Seminar on fission product transport processes in reactor accidents; Dubrovnik, YU; May 22, 1989)			
1	14:26568	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89005338/JAW	MF-000
2	14:26569	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89007206/JAW	MF-000
4	14:26570	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010377/JAW	MF-000
CONF-890554–		(3. world conference on neutron radiography; Osaka, JP; May 14, 1989)			
2	14:26812	*See* DP-MS–88-226			
CONF-890555–		(7. power plant dynamics, control and testing symposium; Knoxville, TN, US; May 15, 1989)			
1	14:26508	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008747/JAW	MF-530
2	14:26534	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008744/JAW	MF-506

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3	14:26905	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008737/JAW	MF-000
4	14:26484	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89008717/JAW	MF-000
6	14:26535	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE8900818/JAW	MF-530
10	14:26539	*See* DOE/NE/37959–28			
11	14:26540	*See* DOE/NE/37959–29			
CONF-890561–		(American Society of Civil Engineers (ASCE) structures conference; San Francisco, CA, US; May 1, 1989)			
2	14:26593	*See* SAND–88-1746C			
3	14:26532	*See* SAND–88-1638C			
4	14:26556	*See* SAND–88-1747C			
CONF-890570–		(International conference on acoustics, speech and signal processing; Glasgow, GB; May 23, 1989)			
2	14:27781	*See* UCRL–99303			
CONF-890571–		(23. aerospace mechanisms symposium; Huntsville, AL, US; May 3, 1989)			
2	14:27058	*See* SAND–88-2442C			
CONF-890584–		(9. conference on roofing technology; Gaithersburg, MD, US; May 4, 1989)			
1	14:26657	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89006628/JAW	MF-350
CONF-890585–		(11. international symposium on ballistics; Brussels, BE; May 9, 1989)			
1	14:26885	*See* SAND–88-2420C			
2	14:27055	*See* UCRL–99492			
3	14:26877	*See* LA-UR–89-579			
4	14:27744	*See* UCRL–99484			
CONF-890589–		(35. international instrumentation symposium; Orlando, FL, US; May 30, 1989)			
1	14:27013	*See* SAND–88-2697C			
CONF-890590–		(DOE computer security conference; Amarillo, TX, US; May 2, 1989)			
1	14:27776	*See* SAND–88-3042C			
2	14:27778	*See* SAND–88-3184C			
3	14:27777	*See* SAND–88-3054C			
4	14:27782	*See* UCRL–100052			
5	14:27770	*See* LA-UR–89-861			
CONF-890591–		(Carnahan conference on security technology; Lexington, KY, US; May 16, 1989)			
1	14:27790	*See* SAND–88-3062C			
CONF-890592–		(35. annual technical meeting of the Institute of Environmental Sciences: building tomorrow's environment; Anaheim, CA, US; May 1, 1989)			
1	14:26671	*See* SAND–88-2580C			
2	14:26888	*See* SAND–89-0376C			
3	14:26886	*See* SAND–88-2530C			
4	14:26890	*See* SAND–89-0538C			
5	14:26889	*See* SAND–89-0537C			
CPDG–					
88-P-016	14:26321	*See* AEEW-M–2513			
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1977	14:26714	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
555	14:26721	*See* AD-A–202471/9/XAB			
562	14:26719	*See* PB–89-158208/XAB			
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010	14:26837	*See* AD-A–202479/2/XAB			
88161	14:27064	*See* AD-A–202485/9/XAB			
CRIQ–					
MAT-88-032	14:26405	Centre de recherche industrielle du Quebec, 333 rue Franquet, CP 9038, Sainte-Foy, PQ, Canada G1V 4C7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
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8820	14:27346	*See* AD-A–203138/3/XAB			
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C-154	14:27040	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000

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95	14:26270	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DCS-SYR–					
88-80	14:27335	*See* AD-A–203419/7/XAB			
DDA-EDR–					
13471	14:26913	*See* AD-A–202426/3/XAB			
DE–					
8208	14:26676	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
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88-54	14:26875	NTIS (US Sales Only), PC A07/MF A01		DE89764604/JAW	MF-000
DFVLR-Mitt.–					
89-02	14:26725	NTIS (US Sales Only), PC A05/MF A01		DE89764552/JAW	MF-000
DLG–					
538010	14:26434	NTIS (US Sales Only), PC A04		DE89764691/JAW	MF-000
DOE/AL/33183–					
T11	14:26716	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010651/JAW	MF-96
DOE/BC/14014–					
9	14:26258	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89000741/JAW	PC-122
DOE/BP/22493–					
2	14:26432	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89011521/JAW	MF-11
DOE/BP/39641–					
4	14:26433	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89011523/JAW	MF-11
DOE/CE–					
0266	14:26622	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011325/JAW	MF-95
DOE/CE/15331–					
T1	14:26658	NTIS, PC A02 - OSTI		DE89010490/JAW	MF-350
DOE/CE/15337–					
T6	14:26435	NTIS, PC A02 - OSTI		DE89010903/JAW	MF-271
DOE/CE/34014–					
T1	14:27329	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89010487/JAW	MF-220
DOE/CE/63525–					
T1	14:26659	NTIS, PC A11 - OSTI		DE89010829/JAW	MF-350
DOE/DP/70033–					
3	14:27785	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010595/JAW	MF-700
DOE/EH–					
0081	14:27057	NTIS, PC A14/MF A01 - OSTI	E 1.99:	DE89010653/JAW	MF-600
DOE/EI/20470–					
T1	14:26265	NTIS, PC A02 - OSTI		DE89010492/JAW	MF-98B
DOE/EIA–					
0035(89/01)	14:26624	NTIS, PC A07/MF A01 - GPO - OSTI	E 1.99:	DE89010941/JAW	MF-98
0130(89/02)	14:26284	NTIS, PC A07/MF A01 - GPO - OSTI	E 1.99:	DE89010970/JAW	MF-98C
0214(87)	14:26646	NTIS, PC A20 - GPO - OSTI		DE89010971/JAW	MF-98
0226(89/01)	14:26632	NTIS, PC A03/MF A01 - GPO - OSTI	E 1.99:	DE89010588/JAW	MF-98E
0292(87)	14:26633	NTIS, PC A04 - GPO - OSTI		DE89010969/JAW	MF-98E
0520(89/04)	14:26266	NTIS, PC A03/MF A01 - GPO - OSTI	E 1.99:	DE89010756/JAW	MF-98B
M033	14:26629	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010704/JAW	MF-98
M035	14:26630	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010705/JAW	MF-98
DOE/EIS–					
0119D	14:27176	NTIS, PC A19/MF A01 - OSTI	E 1.99:	DE89010153/JAW	MF-630
DOE/ER–					
0376	14:27336	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010074/JAW	MF-400
DOE/ER/01198–					
T34	14:26838	NTIS, PC A08/MF A01 - OSTI	E 1.99:	DE89010944/JAW	MF-401
T35	14:26738	Univ. of Illinois at Urbana, Urbana, IL			ND-404
DOE/ER/13118–					
T3	14:27762	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009717/JAW	MF-405
DOE/ER/13189–					
4	14:26807	NTIS, PC A03 - OSTI		DE89010928/JAW	MF-408
DOE/ER/13214–					
3	14:27315	NTIS, PC A02 - OSTI		DE89010931/JAW	MF-408
DOE/ER/13233–					
T1	14:26436	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010493/JAW	MF-408
DOE/ER/13362–					
T1	14:26839	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010642/JAW	MF-401

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DOE/ER/13455–3	14:26437	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010599/JAW	MF-401
DOE/ER/13478–3	14:26783	NTIS, PC A02 - OSTI		DE89010937/JAW	MF-401
DOE/ER/13495–T2	14:27183	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010644/JAW	MF-408
DOE/ER/13508–3	14:26854	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010874/JAW	MF-401
DOE/ER/13542–3	14:26808	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011547/JAW	MF-401
DOE/ER/13604–7	14:26421	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011492/JAW	MF-401
DOE/ER/13617–3	14:26840	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011226/JAW	MF-401
DOE/ER/13626–3	14:26841	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011484/JAW	MF-401
DOE/ER/13743–2	14:26438	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010930/JAW	MF-408
DOE/ER/13767–2	14:27339	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010002/JAW	MF-403
DOE/ER/13789–2	14:26784	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011494/JAW	MF-404
DOE/ER/13796–7	14:27333	NTIS, PC A03 - OSTI		DE89010880/JAW	MF-403
DOE/ER/13896–1	14:27334	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010482/JAW	MF-406
DOE/ER/13907–1	14:27177	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010397/JAW	MF-408
DOE/ER/13909–1	14:27178	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010398/JAW	MF-408
DOE/ER/13913–1	14:27560	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010484/JAW	MF-406
DOE/ER/13965–1	14:27522	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010621/JAW	MF-411
DOE/ER/25054–1	14:26617	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89010483/JAW	MF-400
DOE/ER/25063–T6	14:27763	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010921/JAW	MF-405
DOE/ER/40150–59	14:26920	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010345/JAW	MF-407
DOE/ER/40461–1	14:27593	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010619/JAW	MF-413
DOE/ER/45321–2	14:26763	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010596/JAW	MF-404
DOE/ER/60501–T1	14:27135	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010616/JAW	MF-402
DOE/ET/10815–126	14:26473	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010702/JAW	MF-112
DOE/ET/33006–036	14:26398	NTIS, PC A03 - OSTI		DE89010929/JAW	MF-517
DOE/ET/51013–T210	14:27725	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010945/JAW	MF-420
DOE/ET/53088–366	14:27712	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010617/JAW	MF-422
DOE/FE/61114–1	14:26259	NTIS, PC A11 - OSTI		DE89010932/JAW	MF-122
DOE/ID–					
10112-Rev.3	14:26324	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89011149/JAW	MF-512
10216-Vol.1	14:26548	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89009979/JAW	MF-523
10216-Vol.2	14:26572	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89009980/JAW	MF-523
10216-Vol.3	14:26573	NTIS, PC A08/MF A01 - OSTI	E 1.99:	DE89009981/JAW	MF-523
10216-Vol.4	14:26549	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89009982/JAW	MF-523
10216-Vol.7	14:26550	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89009654/JAW	MF-523
10216-Vol.8	14:26551	NTIS, PC A14/MF A01 - OSTI	E 1.99:	DE89009724/JAW	MF-523
22078	14:26325	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89010979/JAW	MF-70
DOE/ID/12422–2	14:26809	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89008053/JAW	PC-311
DOE/ID/12693–2	14:26462	NTIS, PC A18 - OSTI		DE89010700/JAW	MF-257
DOE/ID/12742–T1	14:26458	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010826/JAW	MF-251

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DOE/IE–					
0014	14:26625	NTIS, PC A03/MF A01 - GPO - OSTI	E 1.99:	DE89010072/JAW	MF-05
DOE/LLW–					
70T	14:26326	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011141/JAW	MF-512
80	14:26327	NTIS, PC A11/MF A01 - OSTI	E 1.99:	DE89011054/JAW	MF-512
DOE/MA–					
0375	14:27745	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89011184/JAW	MF-13
DOE/MC/21179–					
T3	14:26283	NTIS, PC A03/MF A01 - OSTI	E 1.99:	TI88015511/JAW	MF-132
DOE/MC/23287–					
T6	14:26403	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE88014990/JAW	MF-109
DOE/MC/24116–					
T1	14:26204	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89003866/JAW	MF-109
DOE/NE/37959–					
28	14:26539	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010052/JAW	MF-520
29	14:26540	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010053/JAW	MF-520
30	14:26541	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010054/JAW	MF-520
DOE/NV/10574–					
3	14:27208	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009924/JAW	MF-711
DOE/OR/00033–					
T418	14:27764	Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139			ND-400
T419	14:26328	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010158/JAW	MF-400
T422	14:26810	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010610/JAW	MF-406
T423	14:26811	NTIS, PC A09/MF A01 - OSTI	E 1.99:	DE89010611/JAW	MF-401
T424	14:26329	NTIS, PC A15/MF A01 - OSTI	E 1.99:	DE89010612/JAW	MF-402
T425	14:27186	NTIS, PC A08/MF A01 - OSTI	E 1.99:	DE89010613/JAW	MF-406
DOE/OR/21390–					
23	14:26439	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010830/JAW	MF-249
DOE/PC/70029–					
T2	14:26406	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010727/JAW	MF-108
T3	14:26407	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010736/JAW	MF-108
T4	14:26408	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010735/JAW	MF-108
T5	14:26409	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010734/JAW	MF-108
T6	14:26410	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010733/JAW	MF-108
T8	14:26411	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010731/JAW	MF-108
T9	14:26412	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010832/JAW	MF-108
DOE/PC/79907–					
T4	14:26221	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010646/JAW	MF-102
DOE/PC/79909–					
T1	14:26241	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010819/JAW	MF-104
DOE/PC/79928–					
T6	14:26205	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010818/JAW	MF-108
DOE/PC/80908–					
11	14:26206	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010481/JAW	MF-108
DOE/PC/88814–					
T1	14:26207	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010822/JAW	MF-108
DOE/PC/88855–					
T1	14:26208	NTIS, PC A03 - OSTI		DE89010913/JAW	MF-102
DOE/PC/88859–					
T2	14:26242	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010648/JAW	MF-104
DOE/PC/88861–					
T15	14:26222	NTIS, PC A07 - OSTI		DE89010730/JAW	MF-102
DOE/PC/88867–					
T2	14:26229	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010718/JAW	MF-105
DOE/PC/88878–					
T1	14:26199	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010647/JAW	MF-102
T2	14:26200	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010723/JAW	MF-113
DOE/PC/88900–					
T1	14:26243	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010717/JAW	MF-113
DOE/PC/88915–					
T2	14:26209	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010821/JAW	MF-109
DOE/PC/88917–					
T1	14:26210	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010820/JAW	MF-102
DOE/PC/88918–					
1	14:26244	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010618/JAW	MF-106
DOE/PC/90013–					
T7	14:26422	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010787/JAW	MF-108
DOE/PC/90281–					
1	14:26649	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010013/JAW	MF-112
2	14:26650	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010017/JAW	MF-112

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3	14:26651	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010016/JAW	MF-112
4	14:26652	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010015/JAW	MF-112
5	14:26653	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010014/JAW	MF-112
DOE/PC/90909–					
T9	14:26211	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010942/JAW	MF-108
DOE/PE/79013–					
H1	14:26267	NTIS, PC A08/MF A01 - OSTI	E 1.99:	DE89010660/JAW	MF-98B
DOE/PETC/TR–					
89/5	14:26201	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008898/JAW	PC-102
DOE/RL–					
87-04	14:26330	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011039/JAW	MF-721
88-33	14:26331	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89011034/JAW	MF-721
DOE/RW–					
0216	14:26332	OSTI, PO Box 62, Oak Ridge, TN 3783106 - OSTI		TI89010661/JAW	MF-70
DOE/SF/15927–					
T1	14:26660	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009099/JAW	MF-232
DOE/SR-WM–					
89-1	14:26333	NTIS, PC A10 - OSTI		DE89010402/JAW	MF-721
DOE/SWP–					
8901	14:26634	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010833/JAW	MF-13
DOE/WIPP–					
89-011	14:26334	NTIS, PC A15/MF A01 - OSTI	E 1.99:	DE89010654/JAW	MF-70
DP-MS–					
87-172-Rev.1	14:26335	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010458/JAW	MF-721
88-170	14:27746	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE88017001/JAW	MF-705
88-182	14:26336	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010452/JAW	MF-721
88-188	14:26337	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010421/JAW	MF-701
88-226	14:26812	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89007581/JAW	MF-701
88-233	14:26338	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010753/JAW	MF-721
88-236	14:27765	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010748/JAW	MF-702
88-59	14:27136	NTIS, PC A03/MF A01 - OSTI	E 1.99:	TI89010442/JAW	MF-702
89-38	14:26316	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008306/JAW	MF-701
89-47	14:26574	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010473/JAW	MF-701
89-49	14:26903	NTIS, PC A03 - OSTI		DE89010465/JAW	MF-706
DPST–					
88-1194-Rev.1	14:26341	NTIS, PC A17 - OSTI		DE89010418/JAW	MF-702
88-324	14:27160	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010414/JAW	MF-702
88-722-TL	14:26339	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010411/JAW	MF-721
88-967	14:26340	NTIS, PC A10/MF A01 - OSTI	E 1.99:	DE89010475/JAW	MF-701
89-220	14:26342	NTIS, PC A02 - OSTI		DE89010946/JAW	MF-721
89-259	14:26343	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010405/JAW	MF-701
89-271	14:26344	NTIS, PC A04 - OSTI		DE89010404/JAW	MF-721
89-309	14:26345	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010751/JAW	MF-702
89-356	14:26565	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010752/JAW	MF-706
DTH-EI-LHT–					
208	14:26440	NTIS (US Sales Only), PC A03/MF A01		DE88757290/JAW	MF-000
DTH-LV–					
87-17	14:26456	NTIS (US Sales Only), PC A03/MF A01		DE88757291/JAW	MF-000
DTH-LV-MEDD–					
194	14:26451	NTIS (US Sales Only), PC A11/MF A01		DE88757292/JAW	MF-000
ECN–					
89-052	14:27068	Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands			ND-000
89-060	14:27069	Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands			ND-000
EFI-TR–					
3427	14:26429	NTIS (US Sales Only), PC A05/MF A01		DE88757293/JAW	MF-000
3474	14:26430	NTIS (US Sales Only), PC A12/MF A01		DE88757294/JAW	MF-000
3518	14:27786	NTIS (US Sales Only), PC A04/MF A01		DE88757295/JAW	MF-000
3521	14:26478	NTIS (US Sales Only), PC A08/MF A01		DE88757296/JAW	MF-000
EGG-BEG–					
8318	14:26254	NTIS, PC A03 - OSTI		DE89011116/JAW	MF-123
EGG-BNCT–					
8353-Vol.3-No.2	14:27209	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010984/JAW	MF-507
EGG-EE–					
8351	14:26906	NTIS, PC A06 - OSTI		DE89010972/JAW	MF-506
EGG-EP–					
8340	14:26689	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89009743/JAW	MF-310
EGG-M–					
02288	14:26575	NTIS, PC A02 - OSTI		DE89009665/JAW	MF-000
10087	14:26764	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011159/JAW	MF-114

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13887	14:27726	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011146/JAW	MF-425
14987	14:26876	NTIS, PC A02 - OSTI		DE89011137/JAW	MF-510
19687	14:27766	NTIS, PC A02 - OSTI		DE89011150/JAW	MF-000
29587	14:26346	NTIS, PC A03 - OSTI		DE89011140/JAW	MF-70
88171	14:26971	NTIS, PC A02 - OSTI		DE89010974/JAW	MF-506
88266	14:27727	NTIS, PC A02 - OSTI		DE89011145/JAW	MF-425
88512	14:26739	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011133/JAW	MF-406
89011	14:27070	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89009747/JAW	MF-502
89092	14:26460	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011144/JAW	MF-254
EGG-MS–					
8425	14:26677	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010975/JAW	MF-506
EGG-WM–					
8299	14:26347	NTIS, PC A08/MF A01 - OSTI	E 1.99:	DE89010977/JAW	MF-510
EMR–					
1981	14:26599	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
ENEA-RT-FUS–					
88-9	14:27709	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89609767/JAW	MF-000
88-14	14:27728	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89609796/JAW	MF-000
ENEA-RT-TIB–					
88-29	14:27729	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89609812/JAW	MF-000
EPA–					
430/09-88/009	14:27175	*See* PB–89-155527/XAB			
450/3-88/018	14:27095	*See* PB–89-152276/XAB			
450/4-88/010	14:27113	*See* PB–89-159396/XAB			
450/4-88/015	14:27131	*See* PB–89-151286/XAB			
450/4-88/019	14:27133	*See* PB–89-152383/XAB			
450/4-88/020	14:27134	*See* PB–89-152391/XAB			
530/SW-846.3-1	14:26836	*See* PB–89-148076/XAB			
600/3-88/020	14:27154	*See* PB–89-151518/XAB			
600/3-89/015	14:27106	*See* PB–89-155246/XAB			
600/4-88/033A	14:27138	*See* PB–89-151252/XAB			
600/J-88/232	14:27149	*See* PB–89-144646/XAB			
600/J-88/240	14:27150	*See* PB–89-144653/XAB			
600/J-88/242	14:27137	*See* PB–89-145023/XAB			
901/3-88/002	14:27165	*See* PB–89-155774/XAB			
901/3-88/003	14:27166	*See* PB–89-155782/XAB			
901/3-88/004	14:27167	*See* PB–89-155790/XAB			
901/3-88/005	14:27168	*See* PB–89-155808/XAB			
901/7-89/001	14:26608	*See* PB–89-166375/XAB			
901/7-89/002	14:26609	*See* PB–89-166383/XAB			
901/7-89/003	14:26610	*See* PB–89-166391/XAB			
910/9-88/193	14:27169	*See* PB–89-158885/XAB			
910/9-88/194	14:27170	*See* PB–89-158893/XAB			
EPA/AA/TEB–					
89/01	14:26720	*See* PB–89-164271/XAB			
EPA/IMSD–					
88/009	14:27130	*See* PB–89-164909/XAB			
88/014	14:27128	*See* PB–89-164313/XAB			
EPRI-CU–					
6089	14:26635	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6300	14:26636	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6329	14:26717	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6334	14:26690	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EA–					
5870-CCM-Vol.5	14:27146	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EL–					
6275	14:26479	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EM–					
4694	14:26661	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EN–					
6188	14:27041	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000

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EPRI-EN–					
6204	14:27071	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-GS–					
6286	14:26740	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6317	14:26529	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6318	14:26212	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6339	14:26741	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6354	14:26474	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6357	14:26263	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6365	14:26431	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-NP–					
6225	14:26348	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6232-M	14:26494	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6260-M	14:26530	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6285-M	14:26495	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6299	14:26496	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6304	14:26576	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6328	14:26552	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6333	14:26485	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6340	14:26542	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
ERCB–					
ST87-27	14:26637	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $20.00/YR CAN.			ND-000
ESC-WR–					
89-04	14:26604	Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands			ND-000
89-08	14:26626	Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG Petten, Netherlands			ND-000
ESE–					
88103-0106-3140	14:27099	*See* PB–89-152532/XAB			
ESSA/T–					
320-U-564	14:26638	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
ETCA–					
87-R-040	14:26772	*See* PB–89-160469/XAB			
87-R-101	14:26773	*See* PB–89-161350/XAB			
ETSU-L–					
26	14:26413	NTIS (US Sales Only), PC A03		DE89762697/JAW	MF-000
27	14:26414	NTIS (US Sales Only), PC A03/MF A01		DE89762559/JAW	MF-000
EUR–					
11610	14:26509	NTIS (US Sales Only), PC A03/MF A01		TI89764043/JAW	MF-000
11635	14:26507	NTIS (US Sales Only), PC A04/MF A01		TI89764042/JAW	MF-000
11699	14:26497	NTIS (US Sales Only), PC A06/MF A01		TI89764041/JAW	MF-000
11791	14:26349	NTIS (US Sales Only), PC A05/MF A01		TI89763985/JAW	MF-000
11807	14:26498	NTIS (US Sales Only), PC A03/MF A01		TI89764040/JAW	MF-000
11837	14:26350	NTIS (US Sales Only), PC A13/MF A01		TI89763979/JAW	MF-000
FDA/CDRH–					
89/18	14:27330	*See* PB–89-145304/XAB			

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FERIC–					
SR-16	14:26441	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
FNAL-TM–					
1559	14:26930	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011470/JAW	PC-414
1561	14:26944	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011474/JAW	PC-414
1566	14:26945	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011491/JAW	PC-414
1573	14:26973	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011471/JAW	PC-414
1580	14:26946	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011479/JAW	PC-414
1581	14:26947	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011478/JAW	PC-414
1582	14:26948	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011477/JAW	PC-414
FNAL/C–					
88/188-A	14:27567	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011097/JAW	MF-414
89-41-T	14:27566	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011098/JAW	MF-414
89/25-E	14:26972	NTIS, PC A- OSTI		DE89011007/JAW	MF-414
89/36	14:27747	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011083/JAW	MF-400
89/51	14:27767	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011085/JAW	MF-405
89/53	14:26941	NTIS, PC A02 - OSTI		DE89011006/JAW	MF-414
89/55	14:26942	NTIS, PC A03 - OSTI		DE89011101/JAW	MF-414
89/64	14:26929	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011005/JAW	MF-406
89/72	14:26943	NTIS, PC A02 - OSTI		DE89011091/JAW	MF-414
FRCEA-TH–					
181	14:26499	NTIS (US Sales Only), PC A10/MF A01		DE89764016/JAW	MF-000
192	14:26310	NTIS (US Sales Only), PC A08/MF A01		DE89764015/JAW	MF-000
FRNC-TH–					
2331	14:26213	NTIS (US Sales Only), PC A10/MF A01		DE89760550/JAW	MF-000
2425	14:26223	NTIS (US Sales Only), PC A10/MF A01		DE89760551/JAW	MF-000
3006	14:26224	NTIS (US Sales Only), PC A05/MF A01		DE89760556/JAW	MF-000
FRT–					
81-D-1090	14:26225	NTIS (US Sales Only), PC A09/MF A01		DE89760553/JAW	MF-000
82-D-0430	14:26214	NTIS (US Sales Only), PC A03/MF A01		DE89760552/JAW	MF-000
FSC/OPRU–					
2/88	14:26273	*See* PB–89-147144/XAB			
4/88	14:26274	*See* PB–89-147763/XAB			
FSRP-RM–					
282	14:27118	*See* PB–89-162184/XAB			
FSU-STATISTICS-M–					
793	14:27201	*See* AD-A–202440/4/XAB			
GA-A–					
19608	14:27714	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010033/JAW	MF-420
GAO/RCED–					
89-39	14:26618	OSTI - U.S. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877		TI89009972/JAW	MF-000
GCR–					
1988	14:26268	Gulf Canada Resources Limited, Investor and Public Affairs Division, PO Box 130, Calgary, AB, Canada T2P 2H7; $N/C.			ND-000
GRI–					
87/0370	14:26280	*See* PB–89-161368/XAB			
88/0358	14:26292	*See* PB–89-161756/XAB			
88/0359	14:26281	*See* PB–89-161376/XAB			
89/0040	14:26418	*See* SAND–89-0269			
HEDL–					
7658	14:26577	NTIS, PC A03 - OSTI		DE89010165/JAW	MF-520
HEDL-SA–					
3324	14:26510	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010133/JAW	MF-520
3651	14:26578	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010132/JAW	MF-520
3717	14:26579	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010134/JAW	MF-530
HEI/RR–					
88/20	14:27324	*See* PB–89-148977/XAB			
HETA–					
82-195-1200	14:27082	*See* PB–89-145460/XAB			
86-121-1923	14:27096	*See* PB–89-152342/XAB			
86-273-1928	14:27101	*See* PB–89-152623/XAB			
86-356-1930	14:27098	*See* PB–89-152524/XAB			
88-274-1924	14:27100	*See* PB–89-152573/XAB			
HHE–					
75-196-290	14:27084	*See* PB–89-145536/XAB			
76-063-487	14:27322	*See* PB–89-145528/XAB			

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77-007-486	14:27323	*See* PB–89-146344/XAB			
78-025-488	14:27080	*See* PB–89-143341/XAB			
78-047-570	14:27085	*See* PB–89-145593/XAB			
78-074-575	14:27086	*See* PB–89-145627/XAB			
78-092-571	14:27078	*See* PB–89-143234/XAB			
78-104-565	14:27079	*See* PB–89-143242/XAB			
78-114-572	14:27077	*See* PB–89-143226/XAB			
HNEI–					
9010834	14:26619	OSTI - Hawaii Natural Energy Institute, University of Hawaii at Manoa, 2540 Dole Street, Holmes 246, Honolulu, HI 96822		TI89010834/JAW	MF-000
HQ–					
1987	14:26639	Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:26640	Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8803	14:26641	Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, Canada H2Z 1A4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IEA-PUMA-R-B–					
2012	14:26533	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE88706281/JAW	MF-000
IEACG–					
1987	14:26442	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IEC–					
1987	14:26425	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1987	14:26426	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IEN-DITRA–					
13/84	14:26899	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610804/JAW	MF-000
IFSR–					
366	14:27712	*See* DOE/ET/53088–366			
IKE–					
7-11	14:26662	NTIS (US Sales Only), PC A09/MF A01		DE89764517/JAW	MF-000
INDC(UK)–					
043/LN	14:27576	*See* UKNDC–(87)P115			
INFN-LNF–					
88-71(P)	14:26766	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89610237/JAW	MF-000
INIS-BR–					
1458	14:27617	NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS		DE89609976/JAW	MF-000
1469	14:27666	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610508/JAW	MF-000
1470	14:27667	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89610509/JAW	MF-000
INIS-GB–					
185	14:26557	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610900/JAW	MF-000
INIS-SU–					
77/A	14:27630	NTIS (US Sales Only), PC A19/MF A01		DE89780087/JAW	MF-000
79	14:26918	NTIS (US Sales Only), PC A05/MF A01		DE89780088/JAW	MF-000
81/A	14:27292	NTIS (US Sales Only), PC A05/MF A01		DE89780089/JAW	MF-000
INIS-mf–					
11357	14:27162	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE89610309/JAW	MF-000
11392	14:26553	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE88706284/JAW	MF-000
11400	14:27390	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE89609828/JAW	MF-000
11401	14:27415	NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS		DE89609850/JAW	MF-000

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11404	14:27190	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89610549/JAW	MF-000
11405	14:26308	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706287/JAW	MF-000
11406	14:27216	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89610335/JAW	MF-000
11410	14:27554	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89609587/JAW	MF-000
11934	14:26600	NTIS (US Sales Only), PC A18/MF A01		DE89764534/JAW	MF-000
11936	14:26481	NTIS (US Sales Only), PC A04/MF A01		DE89764516/JAW	MF-000
INTERAT–					
1987	14:26305	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IPB-GB–					
11/85	14:26663	Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.)			ND-000
IPC-TR–					
88-001	14:27763	*See* DOE/ER/25063–T6			
88-002	14:27758	*See* CONF-880117–10			
IPEN-PUB–					
184	14:26745	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89610235/JAW	MF-000
223	14:27678	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610533/JAW	MF-000
IVEM–					
14-A	14:26554	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706289/JAW	MF-000
IWS–					
095.12A	14:27083	*See* PB–89-145478/XAB			
JINR–					
19-88-144	14:27296	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706308/JAW	MF-000
E-8-88-360	14:26900	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE88706311/JAW	MF-000
R-10-88-241	14:27010	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706327/JAW	MF-000
R-10-88-321	14:27768	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706329/JAW	MF-000
R-11-88-225	14:27555	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE88706332/JAW	MF-000
R-5-88-221	14:27789	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE88706318/JAW	MF-000
JINR-R–					
13-88-326	14:26561	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE88706339/JAW	MF-000
9-88-149	14:27009	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706319/JAW	MF-000
Juel-Spez–					
469	14:26580	NTIS (US Sales Only), PC A03/MF A01		DE89764711/JAW	MF-000
471	14:26391	NTIS (US Sales Only), PC A03/MF A01		DE89764693/JAW	MF-000
K/DSRD–					
71	14:27769	NTIS, PC A14/MF A01 - OSTI	E 1.99:	DE89010831/JAW	MF-000
K/ESH/FTR–					
1	14:26354	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010622/JAW	MF-510
K/ITP–					
171	14:26315	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010410/JAW	MF-15
K/QT–					
210	14:27749	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89001602/JAW	MF-500
K/TR–					
89/3	14:26385	NTIS, PC A03 - OSTI		DE89010131/JAW	MF-502
KFK–					
4471	14:26355	NTIS (US Sales Only), PC A03/MF A01		DE89764596/JAW	MF-000
4516	14:26859	NTIS (US Sales Only), PC A09/MF A01		DE89764717/JAW	MF-000
4518	14:26317	NTIS (US Sales Only), PC A03/MF A01		DE89764716/JAW	MF-000
KFKI–					
1988-48/G	14:26500	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89610853/JAW	MF-000
1988-63/G	14:26581	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89610830/JAW	MF-000
1988-65/G	14:26582	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610855/JAW	MF-000
1988-66/G	14:26501	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610826/JAW	MF-000
1988-68/G	14:26502	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610856/JAW	MF-000
1988-69/G	14:26503	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89610857/JAW	MF-000
KIYI–					
88-1	14:27679	NTIS (US Sales Only), PC A03/MF A01		DE89780085/JAW	MF-000
88-2	14:27681	NTIS (US Sales Only), PC A03/MF A01		DE89780086/JAW	MF-000
KTM/E-D–					
162	14:27062	NTIS (US Sales Only), PC A04/MF A01		DE88757297/JAW	MF-000
LA–					
11480	14:26313	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010761/JAW	PC-711
11490	14:26314	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010760/JAW	PC-711
11496-OBES	14:26459	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010765/JAW	PC-403
11502-MS	14:27562	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011120/JAW	MF-413
11533-MS	14:26356	NTIS, PC A03 - OSTI		DE89011019/JAW	PC-721
11559-PR	14:27179	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89010544/JAW	PC-408

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11569-M	14:26392	NTIS, PC A17/MF A01 - OSTI	E 1.99:	DE89010766/JAW	MF-15
11576-MS	14:26401	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010684/JAW	MF-706
LA-UR–					
89-1118	14:27127	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009249/JAW	MF-402
89-1159	14:26964	NTIS, PC A02 - OSTI		DE89011198/JAW	MF-414
89-1173	14:27563	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011193/JAW	MF-700
89-1230	14:26938	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011185/JAW	MF-700
89-1273	14:26769	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011177/JAW	MF-704
89-1402	14:27653	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011170/JAW	MF-414
89-1406	14:26965	NTIS, PC A02 - OSTI		DE89011169/JAW	MF-414
89-518	14:27561	NTIS, PC A02 - OSTI		DE89007981/JAW	MF-700
89-579	14:26877	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89007996/JAW	MF-000
89-590	14:26901	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89007994/JAW	MF-32
89-861	14:27770	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89009390/JAW	MF-15
89-868	14:27723	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89009358/JAW	MF-426
LBL–					
24803	14:26357	NTIS, PC A02 - OSTI		DE89010671/JAW	MF-510
25073	14:26358	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010666/JAW	MF-403
25486	14:27336	*See* DOE/ER–0376			
25554	14:26842	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010679/JAW	MF-401
26183	14:27147	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010677/JAW	MF-70
26508	14:26746	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89007497/JAW	MF-404
26547	14:27564	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010678/JAW	MF-414
26792	14:27585	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010680/JAW	MF-414
26805	14:26747	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010681/JAW	MF-401
26895	14:27503	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010673/JAW	MF-412
LIR–					
12-88/330	14:27144	*See* PB–89-158596/XAB			
LMSC/F–					
247028	14:27516	*See* AD-A–203066/6/XAB			
MEA–					
2213	14:26505	*See* NUREG/CR–4929			
2305	14:26531	*See* NUREG/CR–5208			
8703	14:26642	Manitoba Energy Authority, 607-330 Graham Ave., Winnipeg, MB, Canada R3C 4A5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MEM–					
1988	14:26601	Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MHETA–					
88-249-1931	14:27094	*See* PB–89-152250/XAB			
MICROLOG–					
88-05548	14:26627	*See* QME/REG–1988			
88-05563	14:26475	*See* OME–8708			
88-05564	14:26643	*See* MRC–8708			
88-05628	14:26639	*See* HQ–1987			
88-05671	14:26664	*See* MRC–8705			
88-05701	14:26685	*See* AE/SESR–1988			
88-05947	14:26615	*See* ACERR–1987			
88-05968	14:26304	*See* ACR/OSTF–8803			
88-05983	14:26758	*See* WU–15SQ.23440-3-9104			
88-05986	14:26405	*See* CRIQ–MAT-88-032			
89-00123	14:26269	*See* MOG–1987			
89-00436	14:26686	*See* CIPEC–88091888			
89-00436	14:26687	*See* CIPEC–88091888F			
89-00467	14:26472	*See* OH/RD–1988			
89-00636	14:26656	*See* AE/SESR–1988			
89-00640	14:26277	*See* BCMAF/FR–8804			
89-00643	14:27332	*See* AI–1988			
89-00751	14:26270	*See* DA–95			
89-00768	14:26442	*See* IEACG–1987			
89-00771	14:26425	*See* IEC–1987			
89-00771	14:26426	*See* IEC–1987			
89-00797	14:26255	*See* NSRL–1988			
89-00798	14:26286	*See* MPUB–1987			
89-00815	14:26282	*See* BCMEMPR–1987			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-00834	14:26471	*See* NSP–1988			
89-00843	14:26623	*See* QER/BEE–8710			
89-00883	14:26655	*See* AE/SESR–1-260			
89-00964	14:26420	*See* CANMET–MRL-88-33-TR			
89-00976	14:26735	*See* CANMET–PMRL-87-8-TR			
89-01032	14:27066	*See* BCMEP–1987			
89-01060	14:26202	*See* AE/SESR–1988			
89-01071	14:26734	*See* CANMET–PMRL-86-11-TR			
89-01127	14:26666	*See* OAF–88-035			
89-01128	14:26443	*See* OAF/AE–300-20			
89-01129	14:26699	*See* OAF/AE–261-717			
89-01131	14:26667	*See* OAF/AE–774-42			
89-01132	14:26700	*See* OAF/AE–290-731			
89-01133	14:26698	*See* OAF/AE–181-736			
89-01138	14:26702	*See* OAF/AED–88-6507			
89-01139	14:26701	*See* OAF/AED–88-6116			
89-01140	14:26682	*See* AC/R–88-5500			
89-01321	14:26640	*See* HQ–1988			
89-01362	14:26305	*See* INTERAT–1987			
89-01617	14:26718	*See* OTC–EV/88/02			
89-01673	14:26601	*See* MEM–1988			
89-01681	14:26642	*See* MEA–8703			
89-01683	14:26602	*See* NSAEC–8809			
89-01685	14:26644	*See* NBEPC–8806			
89-01688	14:26641	*See* HQ–8803			
89-01849	14:26628	*See* QME/REG–1989			
89-01851	14:26614	*See* QER–1988			
MISC–					
89014	14:26324	*See* DOE/ID–10112-Rev.3			
89025	14:26325	*See* DOE/ID–22078			
89033	14:26327	*See* DOE/LLW–80			
89034	14:26326	*See* DOE/LLW–70T			
MIT–					
9010706	14:26452	The MIT Press, 55 Hayward St., Cambridge, MA 02142			ND-234
MIT-CTP–					
1674	14:27569	*See* NORDITA–88/47-P-Prepr.			
MIT/LCS/TR–					
421	14:27755	*See* AD-A–203150/8/XAB			
MKL-JULK–					
741	14:26427	NTIS (US Sales Only), PC A04/MF A01		DE88757298/JAW	MF-000
MLA–					
11553	14:26707	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
MOG–					
1987	14:26269	Manitoba Oil and Gas Corporation, 870-330 Graham Ave., Winnipeg, MB, Canada R3C 4A5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MPI-H–					
1989-V7	14:27504	NTIS (US Sales Only), PC A03/MF A01		DE89764694/JAW	MF-000
MPUB–					
1987	14:26286	Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, MB, Canada R3C 3L6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MRC–					
8705	14:26664	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
MRC–					
8708	14:26643	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MSP–					
88-1	14:27756	*See* AD-A–203392/6/XAB			
MTI–					
89TR2	14:26704	*See* PB–89-162143/XAB			
MTR–					
89W00031	14:26521	*See* NUREG/CR–5332			
MU/CCORE–					
1987	14:27341	Centre for Cold Ocean Resources Engineering, C-CORE, Memorial University of Nfld., St. John's, NF, Canada A1B 3X5; $N/C.			ND-000
N–					
89-15731	14:26795	NTIS, PC A03/MF A01			ND-00
89-15806	14:27505	NTIS, PC A02/MF A01			ND-00
89-15844	14:27506	NTIS, PC A15/MF A01			ND-00
89-16041	14:26748	NTIS, PC A10/MF A01			ND-00
89-16624	14:27507	NTIS, PC A09/MF A01			ND-00
NA–					
88-0001-VOL-1	14:26683	*See* AD-A–203899/0/XAB			
88-0001-VOL-2	14:26684	*See* AD-A–203900/6/XAB			
NADC–					
88007-60	14:26731	*See* AD-A–203734/9/XAB			
NAS–					
1.15:4063	14:27507	*See* N–89-16624			
1.26:183000	14:27505	*See* N–89-15806			
1.26:183562	14:26748	*See* N–89-16041			
1.26:184584	14:26795	*See* N–89-15731			
1.26:184588	14:27506	*See* N–89-15844			
NASA-CR–					
183000	14:27505	*See* N–89-15806			
183562	14:26748	*See* N–89-16041			
184584	14:26795	*See* N–89-15731			
184588	14:27506	*See* N–89-15844			
NASA-TM–					
4063	14:27507	*See* N–89-16624			
NBEPC–					
8806	14:26644	New Brunswick Electric Power Commission, 515 King St., Fredericton, NB, Canada E3B 4X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NEANDC(E)–					
292-Vol.8	14:27576	*See* UKNDC–(87)P115			
NEB-SS–					
8808	14:26287	Ontario Energy Board, 14 Carlton St., 9th Floor, Toronto, ON, Canada M5B 1J2; $N/C.			ND-000
8809	14:26288	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C.			ND-000
NEI-DK–					
135	14:27072	NTIS (US Sales Only), PC A03/MF A01		DE88757299/JAW	MF-000
137	14:26463	NTIS (US Sales Only), PC A07		DE88757300/JAW	MF-000
138	14:26665	NTIS (US Sales Only), PC A03/MF A01		DE88757301/JAW	MF-000
140	14:26467	NTIS (US Sales Only), PC A05/MF A01		DE88757302/JAW	MF-000
141	14:27073	NTIS (US Sales Only), PC A06/MF A01		DE88757303/JAW	MF-000
142	14:26291	NTIS (US Sales Only), PC A05/MF A01		DE88757304/JAW	MF-000
143	14:26691	NTIS (US Sales Only), PC A04/MF A01		DE88757305/JAW	MF-000
144	14:26692	NTIS (US Sales Only), PC A03/MF A01		DE88757306/JAW	MF-000
145	14:27063	NTIS (US Sales Only), PC A11/MF A01		DE88757307/JAW	MF-000
146	14:26457	NTIS (US Sales Only), PC A04/MF A01		DE88757308/JAW	MF-000
147	14:26693	NTIS (US Sales Only), PC A03/MF A01		DE88757309/JAW	MF-000
148	14:26708	NTIS (US Sales Only), PC A05/MF A01		DE88757310/JAW	MF-000
149	14:26694	NTIS (US Sales Only), PC A04/MF A01		DE88757311/JAW	MF-000
150	14:26695	NTIS (US Sales Only), PC A03/MF A01		DE88757312/JAW	MF-000
151	14:26917	NTIS (US Sales Only), PC A05/MF A01		DE88757313/JAW	MF-000
152	14:26465	NTIS (US Sales Only), PC A03/MF A01		DE88757314/JAW	MF-000
153	14:26709	NTIS (US Sales Only), PC A05/MF A01		DE88757315/JAW	MF-000

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NEI-FI–					
72	14:26226	NTIS (US Sales Only), PC A07		DE88757336/JAW	MF-000
NEI-NO–					
80	14:27074	NTIS (US Sales Only), PC A04/MF A01		DE88757316/JAW	MF-000
NILU-OR–					
35/88	14:27075	NTIS (US Sales Only), PC A05/MF A01		DE88757317/JAW	MF-000
NIOSH/TA–					
76-091	14:26607	*See* PB–89-165211/XAB			
77-66	14:27102	*See* PB–89-152920/XAB			
77-68	14:27103	*See* PB–89-152938/XAB			
NIPER–					
408	14:26260	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010670/JAW	MF-122
NIVA-O–					
86095	14:26271	NTIS (US Sales Only), PC A03/MF A01		DE88757318/JAW	MF-000
NLR-MP–					
88005-U	14:26466	*See* PB–89-153183/XAB			
NMRI–					
88-24	14:27184	*See* AD-A–203111/0/XAB			
88-33	14:27182	*See* AD-A–203112/8/XAB			
NOAA-DR-ERL-ARL–					
16	14:27117	*See* PB–89-159685/XAB			
NORDITA–					
88/47-P-Prepr.	14:27569	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE88706350/JAW	MF-000
NP–					
9764530	14:26696	NTIS (US Sales Only), PC A06/MF A01		DE89764530/JAW	MF-000
9764537	14:27148	NTIS (US Sales Only), PC A06/MF A01		DE89764537/JAW	MF-000
9764597	14:26215	NTIS (US Sales Only), PC A07/MF A01;1V 07/MF A01		DE89764597/JAW	MF-000
9764598	14:26231	NTIS (US Sales Only), PC A09/MF A01		DE89764598/JAW	MF-000
9764599	14:26232	NTIS (US Sales Only), PC A02/MF A01		DE89764599/JAW	MF-000
9764630	14:26631	NTIS (US Sales Only), PC A03/MF A01		DE89764630/JAW	MF-000
9764692	14:26697	NTIS (US Sales Only), PC A06/MF A01		DE89764692/JAW	MF-000
9764710	14:27318	NTIS (US Sales Only), PC A07/MF A01		DE89764710/JAW	MF-000
9770343	14:27163	NTIS (US Sales Only), PC A03/MF A01		DE89770343/JAW	MF-000
NRC–					
9010605	14:26393	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89010605/JAW	MF-731
NREC–					
1626	14:26298	*See* PB–89-152284/XAB			
NRL-MR–					
6347	14:26894	*See* AD-A–202472/7/XAB			
NRL-Memo–					
6335	14:27515	*See* AD-A–202512/0/XAB			
NSAEC–					
8809	14:26602	Newfoundland Statistics Agency, Executive Council, Confederation Bldg., St John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NSP–					
1988	14:26471	Nova Scotia Power Corporation, Barrington Tower, Scotia Square, PO Box 910,, Halifax, NS, Canada B3J 2W5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NSRL–					
1988	14:26255	Nova Scotia Resources Limited, 1657 Bedford Row, PO Box 2111, Stn. M, Halifax, NS, Canada B3J 3B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NTP–					
88-201	14:26605	*See* PB–89-143291/XAB			
NUREG–					
0040-Vol.12-No.4	14:26520	NTIS, PC A04/MF A01 - GPO - OSTI		TI89010744/JAW	MF-000
0430-Vol.9-No.1	14:26394	NTIS, PC A03/MF A01 - GPO - OSTI		TI89009932/JAW	MF-000
0904-Suppl.1-Vol.2	14:26388	NTIS, PC A99/MF A01 - GPO - OSTI		TI89010632/JAW	MF-000
1137-Suppl.9	14:26583	NTIS, PC A03/MF A01 - GPO - OSTI		TI89009971/JAW	MF-000
1232-Vol.3	14:26584	NTIS, PC A05/MF A01 - GPO - OSTI		TI89010641/JAW	MF-000
1275-Vol.4	14:26483	NTIS, PC A06/MF A01 - GPO - OSTI		TI89010202/JAW	MF-000
1275-Vol.5	14:26585	NTIS, PC A13/MF A01 - GPO - OSTI		TI89010583/JAW	MF-000
1342	14:26543	NTIS, PC A03/MF A01 - GPO - OSTI		TI89010745/JAW	MF-000

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NUREG–					
1346	14:26486	NTIS, PC A19/MF A01 - GPO - OSTI		TI89010208/JAW	MF-000
1348	14:26586	NTIS, PC A06/MF A01 - GPO - OSTI		TI89010209/JAW	MF-000
1359	14:26504	NTIS, PC A20/MF A01 - GPO - OSTI		TI89010126/JAW	MF-000
NUREG/CP–					
0097-Vol.2	14:26587	NTIS, PC A17/MF A01 - GPO - OSTI		TI89010210/JAW	MF-000
0097-Vol.3	14:26588	NTIS, PC A24/MF A01 - GPO - OSTI		TI89010313/JAW	MF-000
0097-Vol.4	14:26589	NTIS, PC A99/MF A01 - GPO - OSTI		TI89010159/JAW	MF-000
NUREG/CR–					
3950-Vol.5	14:26487	NTIS, PC A07/MF A01 - GPO - OSTI		TI89009055/JAW	MF-000
4219-Vol.5-No.2	14:26488	NTIS, PC A05/MF A01 - GPO - OSTI		TI89009913/JAW	MF-000
4721	14:26555	NTIS, PC A03/MF A01 - GPO - OSTI		TI89010768/JAW	MF-000
4929	14:26505	NTIS, PC A06/MF A01 - GPO - OSTI		TI89010204/JAW	MF-000
5081	14:26395	NTIS, PC A07/MF A01 - GPO - OSTI		TI89010207/JAW	MF-000
5089	14:26359	NTIS, PC A13/MF A01 - GPO - OSTI		TI89010203/JAW	MF-000
5124	14:26590	NTIS, PC A15/MF A01 - GPO - OSTI		TI89008165/JAW	MF-000
5172	14:26396	NTIS, PC A13/MF A01 - GPO - OSTI		TI89010682/JAW	MF-000
5208	14:26531	NTIS, PC A05/MF A01 - GPO - OSTI		TI89010746/JAW	MF-000
5261	14:26591	NTIS, PC A06/MF A01 - GPO - OSTI		TI89010062/JAW	MF-000
5279	14:26360	NTIS, PC A03/MF A01 - GPO - OSTI		TI89009977/JAW	MF-000
5283	14:26489	NTIS, PC A03/MF A01 - GPO - OSTI		TI89010872/JAW	MF-000
5330	14:26749	NTIS, PC A07/MF A01 - GPO - OSTI		TI89010990/JAW	MF-000
5332	14:26521	NTIS, PC A04/MF A01 - GPO - OSTI		TI89009933/JAW	MF-000
5355	14:26592	NTIS, PC A04/MF A01 - GPO - OSTI		TI89010231/JAW	MF-000
NVO–					
326	14:26361	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010665/JAW	MF-70
OAF–					
88-035	14:26666	Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OAF/AE–					
181-736	14:26698	Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
261-717	14:26699	Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
290-731	14:26700	Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
300-20	14:26443	Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
774-42	14:26667	Ontario Ministry of Agriculture and Food, Consumer Information Centre, 801 Bay St., Main Floor, Toronto, ON, Canada M7A 2B2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OAF/AED–					
88-6116	14:26701	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

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88-6507	14:26702	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OH/RD–					
1988	14:26472	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OME–					
8708	14:26475	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ORF/ES–					
8006	14:26620	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
ORNL/Sub–					
87-56553/1	14:26710	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89010310/JAW	MF-000
ORNL/TM–					
10366	14:26555	*See* NUREG/CR–4721			
10847	14:26318	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010188/JAW	PC-526
10907	14:26519	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010299/JAW	MF-528
11083	14:26749	*See* NUREG/CR–5330			
11150	14:26562	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010200/JAW	MF-523
9593-Vol.5-No.2	14:26488	*See* NUREG/CR–4219-Vol.5-No.2			
ORNL/tr–					
89/13	14:26506	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010220/JAW	MF-523
89/17	14:26491	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010221/JAW	MF-520
89/18	14:26563	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010219/JAW	MF-520
89/9	14:26490	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010222/JAW	MF-523
OSFP/FH–					
0012	14:26261	*See* PB–89-160162/XAB			
OTC–					
EV/88/02	14:26718	Ontario Ministry of Transportation and Communications, Research and Development Branch, 1201 Wilson Ave., Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OY/PSTL-RR–					
83	14:26603	NTIS (US Sales Only), PC A03/MF A01		DE88757319/JAW	MF-000
OY/PSTL-TIED–					
54	14:26289	NTIS (US Sales Only), PC A03/MF A01		DE88757320/JAW	MF-000
PARAMETER/IE–					
174	14:26489	*See* NUREG/CR–5283			
PATENTS-USA–					
Application7-276,981	14:26895	NTIS, PC A02/MF A01			ND-00
Application7-245,176	14:26896	NTIS, PC A03/MF A01			ND-00
PATENTS-US–					
A7117880	14:26319	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010948/JAW	MF-404
A7118075	14:27771	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010949/JAW	MF-706
A7118076	14:26796	NTIS, PC A03 - OSTI		DE89010950/JAW	MF-701
A7119878	14:26907	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010951/JAW	MF-706
A7123462	14:26320	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010952/JAW	MF-704
A7126153	14:27043	NTIS, PC A03 - OSTI		DE89010954/JAW	MF-706
A7126156	14:27044	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010956/JAW	MF-706
A7126159	14:27045	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010957/JAW	MF-706
A7129208	14:26878	NTIS, PC A03 - OSTI		DE89010958/JAW	MF-706
A7129209	14:27046	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010959/JAW	MF-406
A7130926	14:27076	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010962/JAW	MF-706
A7146644	14:26879	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010894/JAW	MF-406
A7147825	14:26597	NTIS, PC A03 - OSTI		DE89010896/JAW	MF-406

PATENTS-US–

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A7148530	14:26770	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010812/JAW	MF-704
A7150805	14:27053	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010899/JAW	MF-706
A7155439	14:27054	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010810/JAW	MF-741
A7155450	14:26797	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010809/JAW	MF-701
A7155452	14:26216	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010808/JAW	MF-109
A7166343	14:26278	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010815/JAW	MF-706
A7166581	14:27011	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010813/JAW	MF-706
A7166582	14:26966	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010814/JAW	MF-406
A7204432	14:26798	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010798/JAW	MF-704
A7207487	14:26799	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010799/JAW	MF-706
A7207562	14:26230	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010800/JAW	MF-105
A7207806	14:26771	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89010801/JAW	MF-404
A7209119	14:26800	NTIS, PC A03 - OSTI		DE89010967/JAW	MF-704
A7209168	14:27741	NTIS, PC A03 - OSTI		DE89010966/JAW	MF-712
A7209238	14:27772	NTIS, PC A03 - OSTI		DE89010965/JAW	MF-705
A7209397	14:26598	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010964/JAW	MF-210
PB–					
89-143226/XAB	14:27077	NTIS, PC A03/MF A01			ND-00
89-143234/XAB	14:27078	NTIS, PC A03/MF A01			ND-00
89-143242/XAB	14:27079	NTIS, PC A03/MF A01			ND-00
89-143291/XAB	14:26605	NTIS, PC A17/MF A01			ND-00
89-143341/XAB	14:27080	NTIS, PC A02/MF A01			ND-00
89-144646/XAB	14:27149	NTIS, PC A03/MF A01			ND-00
89-144653/XAB	14:27150	NTIS, PC A03/MF A01			ND-00
89-144695/XAB	14:27081	NTIS, PC A03/MF A01			ND-00
89-145023/XAB	14:27137	NTIS, PC A02/MF A01			ND-00
89-145304/XAB	14:27330	NTIS, PC A03/MF A01			ND-00
89-145346/XAB	14:27319	NTIS, PC EE02/MF A01			ND-00
89-145460/XAB	14:27082	NTIS, PC A03/MF A01			ND-00
89-145478/XAB	14:27083	NTIS, PC A02/MF A01			ND-00
89-145502/XAB	14:27320	NTIS, PC A05/MF A01			ND-00
89-145510/XAB	14:27321	NTIS, PC A04/MF A01			ND-00
89-145528/XAB	14:27322	NTIS, PC A02/MF A01			ND-00
89-145536/XAB	14:27084	NTIS, PC A02/MF A01			ND-00
89-145593/XAB	14:27085	NTIS, PC A03/MF A01			ND-00
89-145627/XAB	14:27086	NTIS, PC A03/MF A01			ND-00
89-145742/XAB	14:26668	NTIS, PC EE07/MF A01			ND-00
89-145965/XAB	14:27087	NTIS, PC A03/MF A01			ND-00
89-146252/XAB	14:26272	NTIS, PC A06/MF A01			ND-00
89-146344/XAB	14:27323	NTIS, PC A03/MF A01			ND-00
89-147144/XAB	14:26273	NTIS, PC EE07/MF E07			ND-00
89-147227/XAB	14:26801	NTIS, PC EE04/MF E04			ND-00
89-147292/XAB	14:26306	NTIS, PC A05/MF A01			ND-00
89-147763/XAB	14:26274	NTIS, PC EE05/MF E05			ND-00
89-148076/XAB	14:26836	NTIS, PC A99/MF E04			ND-00
89-148241/XAB	14:27508	NTIS, PC EE02/MF A01			ND-00
89-148274/XAB	14:27088	NTIS, PC A04/MF A01			ND-00
89-148282/XAB	14:27089	NTIS, PC A05/MF A01			ND-00
89-148423/XAB	14:26613	NTIS, PC A03/MF A01			ND-00
89-148456/XAB	14:27151	NTIS, PC A09/MF A01			ND-00
89-148597/XAB	14:27090	NTIS, PC A05/MF A01			ND-00
89-148977/XAB	14:27324	NTIS, PC A04/MF A01			ND-00
89-149744/XAB	14:26678	NTIS, PC A03/MF A01			ND-00
89-149751/XAB	14:27152	NTIS, PC A08/MF A01			ND-00
89-150593/XAB	14:26703	NTIS, PC EE04/MF A01			ND-00
89-151252/XAB	14:27138	NTIS, PC A09/MF A01			ND-00
89-151286/XAB	14:27131	NTIS, PC A10/MF A01			ND-00
89-151351/XAB	14:27132	NTIS, PC A04/MF A01			ND-00
89-151393/XAB	14:26415	NTIS, PC A04/MF A01			ND-00
89-151401/XAB	14:26416	NTIS, PC A04/MF A01			ND-00
89-151443/XAB	14:27153	NTIS, PC A04/MF A01			ND-00
89-151476/XAB	14:26669	NTIS, PC A13/MF A01			ND-00
89-151492/XAB	14:27325	NTIS, PC A02/MF A01			ND-00
89-151518/XAB	14:27154	NTIS, PC A09/MF A01			ND-00
89-151526/XAB	14:27091	NTIS, PC A10/MF A01			ND-00
89-151534/XAB	14:27092	NTIS, PC A04/MF A01			ND-00
89-151542/XAB	14:27093	NTIS, PC A05/MF A01			ND-00
89-152037/XAB	14:27173	NTIS, PC A07/MF A01			ND-00
89-152086/XAB	14:27509	NTIS, PC A07/MF A01			ND-00
89-152094/XAB	14:27510	NTIS, PC A05/MF A01			ND-00
89-152250/XAB	14:27094	NTIS, PC A03/MF A01			ND-00

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-152276/XAB	14:27095	NTIS, PC A06/MF A01			ND-00
89-152284/XAB	14:26298	NTIS, PC A10/MF A01			ND-00
89-152342/XAB	14:27096	NTIS, PC A03/MF A01			ND-00
89-152383/XAB	14:27133	NTIS, PC A04/MF A01			ND-00
89-152391/XAB	14:27134	NTIS, PC A03/MF A01			ND-00
89-152409/XAB	14:27097	NTIS, PC A11/MF A01			ND-00
89-152482/XAB	14:27521	NTIS, PC A10/MF A01			ND-00
89-152524/XAB	14:27098	NTIS, PC A03/MF A01			ND-00
89-152532/XAB	14:27099	NTIS, PC A11/MF A01			ND-00
89-152573/XAB	14:27100	NTIS, PC A03/MF A01			ND-00
89-152623/XAB	14:27101	NTIS, PC A04/MF A01			ND-00
89-152698/XAB	14:27174	NTIS, PC A09/MF A01			ND-00
89-152748/XAB	14:26250	NTIS, PC A05/MF A01			ND-00
89-152755/XAB	14:26251	NTIS, PC A03/MF A01			ND-00
89-152920/XAB	14:27102	NTIS, PC A03/MF A01			ND-00
89-152938/XAB	14:27103	NTIS, PC A03/MF A01			ND-00
89-153084/XAB	14:27155	NTIS, PC A08/MF A01			ND-00
89-153092/XAB	14:27156	NTIS, PC A13/MF A01			ND-00
89-153183/XAB	14:26466	NTIS, PC EE02/MF A01			ND-00
89-153274/XAB	14:27157	NTIS, PC A99/MF E04			ND-00
89-153464/XAB	14:26480	NTIS, PC EE04/MF A01			ND-00
89-153944/XAB	14:27104	NTIS, PC EE03/MF A01			ND-00
89-154116/XAB	14:26606	NTIS, PC A03/MF A01			ND-00
89-154942/XAB	14:26290	NTIS, PC EE03/MF E03			ND-00
89-155204/XAB	14:27143	NTIS, PC A09/MF A01			ND-00
89-155238/XAB	14:27105	NTIS, PC A14/MF A01			ND-00
89-155246/XAB	14:27106	NTIS, PC A08/MF A01			ND-00
89-155253/XAB	14:27107	NTIS, PC A07/MF A01			ND-00
89-155527/XAB	14:27175	NTIS, PC A04/MF A01			ND-00
89-155576/XAB	14:26296	NTIS, PC A08/MF A01			ND-00
89-155675/XAB	14:26423	NTIS, PC A02/MF A01			ND-00
89-155758/XAB	14:27108	NTIS, PC A04/MF A01			ND-00
89-155774/XAB	14:27165	NTIS, PC A03/MF A01			ND-00
89-155782/XAB	14:27166	NTIS, PC A03/MF A01			ND-00
89-155790/XAB	14:27167	NTIS, PC A14/MF A01			ND-00
89-155808/XAB	14:27168	NTIS, PC A04/MF A01			ND-00
89-155857/XAB	14:27164	NTIS, PC A06/MF A01			ND-00
89-156020/XAB	14:26645	NTIS, PC EE03/MF A01			ND-00
89-156087/XAB	14:27109	NTIS, PC A15/MF A01			ND-00
89-156095/XAB	14:27110	NTIS, PC A03/MF A01			ND-00
89-156111/XAB	14:27111	NTIS, PC A03/MF A01			ND-00
89-158208/XAB	14:26719	NTIS, PC A04/MF A01			ND-00
89-158596/XAB	14:27144	NTIS, PC A13/MF A01			ND-00
89-158661/XAB	14:26297	NTIS CP T02			ND-00
89-158745/XAB	14:27112	NTIS, PC A04/MF A01			ND-00
89-158885/XAB	14:27169	NTIS, PC A03/MF A01			ND-00
89-158893/XAB	14:27170	NTIS, PC A03/MF A01			ND-00
89-159214/XAB	14:26647	NTIS, PC EE11/MF A01			ND-00
89-159396/XAB	14:27113	NTIS, PC A07/MF A01			ND-00
89-159461/XAB	14:27114	NTIS CP T03			ND-00
89-159479/XAB	14:27115	NTIS, PC A13/MF A01			ND-00
89-159602/XAB	14:27511	NTIS, PC A03/MF A01			ND-00
89-159628/XAB	14:27116	NTIS, PC A07/MF A01			ND-00
89-159685/XAB	14:27117	NTIS, PC A06/MF A01			ND-00
89-159784/XAB	14:26750	NTIS, PC A03/MF A01			ND-00
89-159800/XAB	14:26233	NTIS, PC A03/MF A01			ND-00
89-159917/XAB	14:26417	NTIS, PC A05/MF A01			ND-00
89-160006/XAB	14:27145	NTIS, PC A04/MF A01			ND-00
89-160162/XAB	14:26261	NTIS, PC A06/MF A01			ND-00
89-160469/XAB	14:26772	NTIS, PC EE04/MF E04			ND-00
89-161350/XAB	14:26773	NTIS, PC EE04/MF E04			ND-00
89-161368/XAB	14:26280	NTIS, PC A04/MF A01			ND-00
89-161376/XAB	14:26281	NTIS, PC A03/MF A01			ND-00
89-161418/XAB	14:26294	NTIS, PC A05/MF A01			ND-00
89-161434/XAB	14:26285	NTIS, PC A07/MF A01			ND-00
89-161442/XAB	14:26217	NTIS, PC A07/MF A01			ND-00
89-161467/XAB	14:26299	NTIS, PC A03/MF A01			ND-00
89-161491/XAB	14:26711	NTIS, PC A04/MF A01			ND-00
89-161715/XAB	14:26679	NTIS, PC A08/MF A01			ND-00
89-161756/XAB	14:26292	NTIS, PC A07/MF A01			ND-00
89-161772/XAB	14:26476	NTIS, PC A25/MF A01			ND-00

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89-161780/XAB	14:26477	NTIS, PC A05/MF A01			ND-00
89-162010/XAB	14:26252	NTIS, PC A04/MF A01			ND-00
89-162085/XAB	14:27297	NTIS, PC A04			ND-00
89-162143/XAB	14:26704	NTIS, PC A04/MF A01			ND-00
89-162184/XAB	14:27118	NTIS, PC A03/MF A01			ND-00
89-163018/XAB	14:26705	NTIS, PC A07/MF A01			ND-00
89-164271/XAB	14:26720	NTIS, PC A09/MF A01			ND-00
89-164313/XAB	14:27128	NTIS, PC A10/MF A01			ND-00
89-164909/XAB	14:27130	NTIS, PC A05/MF A01			ND-00
89-165195/XAB	14:26253	NTIS, PC A03/MF A01			ND-00
89-165211/XAB	14:26607	NTIS, PC A03/MF A01			ND-00
89-165229/XAB	14:27119	NTIS, PC A03/MF A01			ND-00
89-165369/XAB	14:26712	NTIS, PC A11/MF A01			ND-00
89-165559/XAB	14:26444	NTIS, PC A05/MF A01			ND-00
89-166375/XAB	14:26608	NTIS, PC A04/MF A01			ND-00
89-166383/XAB	14:26609	NTIS, PC A07/MF A01			ND-00
89-166391/XAB	14:26610	NTIS, PC A06/MF A01			ND-00
89-167431/XAB	14:26293	NTIS, PC A07/MF A01			ND-00
89-858161/XAB	14:27326	NTIS PC N01/MF N01			ND-00
89-858385/XAB	14:27120	NTIS PC N01/MF N01			ND-00
89-858617/XAB	14:26880	NTIS PC N01/MF N01			ND-00
89-858732/XAB	14:26751	NTIS PC N01/MF N01			ND-00
89-858740/XAB	14:26389	NTIS PC N01/MF N01			ND-00
89-858757/XAB	14:26390	NTIS PC N01/MF N01			ND-00
89-858831/XAB	14:27158	NTIS PC N01/MF N01			ND-00
89-858922/XAB	14:26802	NTIS PC N01/MF N01			ND-00
89-858955/XAB	14:27773	NTIS PC N01/MF N01			ND-00
89-858997/XAB	14:27139	NTIS PC N01/MF N01			ND-00
89-859003/XAB	14:27140	NTIS PC N01/MF N01			ND-00
89-859045/XAB	14:26881	NTIS PC N01/MF N01			ND-00
89-859094/XAB	14:27331	NTIS PC N01/MF N01			ND-00
89-859144/XAB	14:26611	NTIS PC N01/MF N01			ND-00
89-859268/XAB	14:26752	NTIS PC N01/MF N01			ND-00
89-859276/XAB	14:26882	NTIS PC N01/MF N01			ND-00
89-859284/XAB	14:27047	NTIS PC N01/MF N01			ND-00
89-859292/XAB	14:27180	NTIS PC N01/MF N01			ND-00
89-859300/XAB	14:27181	NTIS PC N01/MF N01			ND-00
89-859433/XAB	14:27121	NTIS PC N01/MF N01			ND-00
89-859631/XAB	14:26883	NTIS PC N01/MF N01			ND-00
89-901900/XAB	14:26402	NTIS Subscription			ND-00
89-902100/XAB	14:26648	NTIS Subscription			ND-00
PFC/RR–					
88-17	14:27725	*See* DOE/ET/51013–T210			
PINSTECH/NCD–					
109	14:27122	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706353/JAW	MF-000
PINSTECH/NED–					
130	14:26564	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE88706354/JAW	MF-000
PIRSEM–					
2055	14:26218	NTIS (US Sales Only), PC A04/MF A01		DE89760555/JAW	MF-000
PNL–					
3594-Rev.9	14:26397	NTIS, PC A12 - OSTI		DE89011333/JAW	MF-70
5176-Add.1	14:26362	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89010635/JAW	MF-85
5210-Vol.5	14:26487	*See* NUREG/CR–3950-Vol.5			
6717	14:26492	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89009715/JAW	MF-85
6772	14:26363	NTIS, PC A10/MF A01 - OSTI	E 1.99:	DE89011026/JAW	MF-502
6800-Pt.4	14:27683	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010762/JAW	MF-408
6805	14:26774	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010283/JAW	MF-313
6839	14:26670	Battelle Memorial Institute, Pacific Northwest Laboratory,Richland, WA 99352			ND-250
6852	14:26364	NTIS, PC A05/MF A01 - OSTI	E 1.99:	DE89011028/JAW	MF-11
6857	14:26365	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011027/JAW	MF-85
6861	14:26884	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010284/JAW	MF-000
PNL-SA–					
16187	14:26775	NTIS, PC A03 - OSTI		DE89011219/JAW	MF-404
16256	14:27704	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011205/JAW	MF-420
16311	14:26753	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011206/JAW	MF-504
16327	14:26366	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89009380/JAW	MF-510
16365	14:27159	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011210/JAW	MF-603
16474	14:26754	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011214/JAW	MF-404
16491	14:26367	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011203/JAW	MF-510
16582	14:26368	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011204/JAW	MF-510

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16871	14:26369	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011157/JAW	MF-510
16887	14:26370	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89011216/JAW	MF-721
PPRP/PPER-R–					
12	14:27164	*See* PB–89-155857/XAB			
PRI–					
1981-1	14:26262	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
1981-6	14:26256	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
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1913	14:26398	*See* DOE/ET/33006–036			
PTL-PUB–					
654	14:27110	*See* PB–89-156095/XAB			
PWA–					
1/89	14:26317	*See* KFK–4518			
QER–					
1988	14:26614	Ministere de l'Energie et des Ressources, Direction de la Recherche et du Developpement (Forets), 2700, rue Einstein, Sainte-Foy, PQ, Canada G1P 3W8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
QER/BEE–					
8710	14:26623	Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
QME/REG–					
1988	14:26627	Regie de l'electricite et du gaz (Quebec), 2100 rue Drummond, Montreal, PQ, Canada H3G 1X1; $2.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1989	14:26628	Regie de l'electricite et du gaz (Quebec), 2100 rue Drummond, Montreal, PQ, Canada H3G 1X1; $2.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
REPT–					
1988-350	14:27104	*See* PB–89-153944/XAB			
78	14:26645	*See* PB–89-156020/XAB			
88-1A	14:26306	*See* PB–89-147292/XAB			
88/30	14:27508	*See* PB–89-148241/XAB			
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8/86	14:26843	NTIS (US Sales Only), PC A06		DE88757321/JAW	MF-000
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4335	14:27129	NTIS, PC A02 - OSTI		DE89010428/JAW	MF-702
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2709	14:26468	NTIS (US Sales Only), PC A04		DE88757322/JAW	MF-000
2749	14:26464	NTIS (US Sales Only), PC A03/MF A01		DE88757323/JAW	MF-000
2762	14:26469	NTIS (US Sales Only), PC A05/MF A01		DE88757324/JAW	MF-000
2763	14:26470	NTIS (US Sales Only), PC A03/MF A01		DE88757325/JAW	MF-000
SAE–					
1944-1-1-1	14:26621	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
1944-1-1-1	14:26713	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
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85-0598	14:26372	NTIS, PC A12/MF A01 - OSTI	E 1.99:	DE89010528/JAW	MF-70
87-2833	14:26373	NTIS, PC A07/MF A01 - OSTI	E 1.99:	DE89011468/JAW	MF-70

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88-0141	14:26359	*See* NUREG/CR–5089			
88-0626	14:26680	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89008950/JAW	PC-722
88-1065	14:26374	NTIS, PC A12 - OSTI		DE89010522/JAW	MF-70
88-1471	14:26375	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89009696/JAW	PC-702
88-1615C	14:27774	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89003610/JAW	MF-705
88-1638C	14:26532	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89003140/JAW	MF-000
88-1746C	14:26593	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89002893/JAW	MF-706
88-1747C	14:26556	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89002891/JAW	MF-000
88-2183C	14:26904	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009067/JAW	MF-704
88-2207	14:26376	NTIS, PC A06/MF A01 - OSTI	E 1.99:	DE89010541/JAW	MF-70
88-2327	14:27012	NTIS, PC A04/MF A01 - OSTI	E 1.99:	DE89010529/JAW	MF-700
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194	14:26672	Available on loan from Risoe Library, DK-4000 Roskilde.			ND-000
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C-3	14:26914	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
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211-3448	14:26446	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89000890/JAW	MF-271
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1-1988	14:26428	Skovteknisk Institut, Amalievej 20, DK-1875 Frederiksberg C			ND-000
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861101-1	14:26275	NTIS (US Sales Only), PC A04/MF A01		DE88757326/JAW	MF-000

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SNC–					
C-118	14:26448	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
SP-RAPP–					
1988:51	14:26668	*See* PB–89-145742/XAB			
SRI-ENV–					
89-228-6657-8	14:26229	*See* DOE/PC/88867–T2			
SSA–					
1988-TS-9	14:27298	NTIS (US Sales Only), PC A14/MF A01		DE89764017/JAW	MF-000
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11-A88058	14:26290	*See* PB–89-154942/XAB			
15A85021	14:26902	NTIS (US Sales Only), PC A05/MF A01		DE88757327/JAW	MF-000
15A87044	14:26245	NTIS (US Sales Only), PC A03/MF A01		DE88757328/JAW	MF-000
A86053	14:26276	NTIS (US Sales Only), PC A03/MF A01		DE88757329/JAW	MF-000
SVC–					
87-51	14:27123	Available on loan from Risoe Library, DK-4000 Roskilde.			ND-000
SWRI–					
9010919	14:26295	American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 $65.00			ND-000
TKK-KO/ET–					
28	14:26246	NTIS (US Sales Only), PC A07/MF A01		DE88757330/JAW	MF-000
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0088(3940-05)-6	14:27517	*See* AD-A–203172/2/XAB			
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UA–					
9010788	14:26892	OSTI - School of Mines and Energy Development, Box 6282, The University of Alabama, Tuscaloosa, AL 35487		TI89010788/JAW	MF-000
9010789	14:26219	OSTI - School of Mines and Energy Development, Box 6282, The University of Alabama, Tuscaloosa, AL 35487		TI89010789/JAW	MF-000
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97983	14:27049	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89011631/JAW	MF-706
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UKNDC–					
(87)P115	14:27576	United Kingdom Atomic Energy Authority, Harwell Laboratory, Oxfordshire, OX11 ORA, England			MF-000
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88-014	14:27754	*See* AD-A–203092/2/XAB			

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USDA/AIB–					
559	14:26423	*See* PB–89-155675/XAB			
USGS/MAP/I–					
2018	14:26379	US Geological Survey, Map Distribution, Federal Center, Box 25286, Denver, CO 80225		TI89010910/JAW	MF-70
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89-4006	14:27125	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89010740/JAW	MF-70
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89-7	14:26893	NTIS, PC A05 - OSTI		DE89010754/JAW	MF-700
WU–					
15SQ.23440-3-9104	14:26758	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

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The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

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TG	Translation (general)
TA	Translation (analytic)

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TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
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